LAPORAN TEKNIS 2015

08.f/AIR 2/OT 02 02/01/2016

*APPLYING NUCLEAR TECHNOLOGY TO ENHANCE
CLIMATE CHANGE RESEARCH AND SUPPORT AN
OBSERVATION FOR CORALS (TC-INS7006)*

Ali Arman, Aditya Dwi Permana dan Untung Sugiharto

batan

PUSAT APLIKASI ISOTOP DAN RADIASI
BADAN TENAGA NUKLIR NASIONAL
2016

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APPLYING NUCLEAR TECHNOLOGY TO ENHANCE CLIMATE CHANGE RESEARCH AND SUPPORT AN OBSERVATION FOR CORALS (TC-INS7006)

Ali Arman, Aditya Dwi Permana dan Untung Sugiharto

Mengetahui/Menyetujui

Kepala Bidang Industri dan Lingkungan	Kepala Pusat Aplikasi Isotop dan Radiasi
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Applying Nuclear Technology to Enhance Climate Change Research and Support an Observation Plan for Corals (TC-INS7006)

Ali Arman, Aditya Dwi Permana dan Untung Sugiharto

I.   Laporan kemajuan (PPAR) periode Januari 2015-Juni 2015

PROJECT PROGRESS ASSESSMENT REPORT (PPAR)
National Projects

		Explanations
SECTION-1: BASIC INFORMATION		
Project Number and Title	INS7006, Applying Nuclear Technologies to Enhance Climate Change Research and Support an Observation Plan for Corals	*(Prefilled)*
Country	INDONESIA	
Counterpart Name & Institution	1. Mr. Ali Arman Center for Isotopes and Radiation Application National Nuclear Energy Agency Indonesia-BATAN 2. Mr. Agus Setiawan Institute of Marine Research and Observation Ministry of Marine Affair and Fisheries Indonesia	
1st Year of Approval	2011	
Estimated Duration	4 years	
Expected End Date	30-06-2015	
Total Project Budget *(as per IAEA White Book)*	EBT-USA06-11-02: €106,288.00 EBT-USA01-12-04: €188,370.00 Total : €294,658.00	
Reporting Period	☒ January - June 2015 ☐ July – December	*Tick one reporting period*
Report Contributors		*Other contributors to the report besides counterpart*
Has there been any major change that affected the project?	☐ Yes ☒ No If yes, tick to specify nature of change(s): ☐ CP[1] ☐ NLO[2] ☐ PMO[3] ☐ TO[4] ☐ Budget/funding; ☐ Other *(specify)* [Provide explanation]......	*Select "Yes" or "No" and, if "Yes", please tick relevant box(es) and describe nature of impact*
SECTION-2: OUTPUTS ACHIEVEMENT		
Select status of Output and briefly describe elements of progress towards target indicators: *(1st column prefilled)*		
Output 1: Climate change evidence information & database on corals of	☒ Completed ☐ On schedule ☐ Delayed ☐ Other *(specify)* [Provide explanation] Massive corals of *Porites Lutea, Porites Lobata* and *Diploastrea Heliopora* have been collected from the Coral Triangle Initiative (CTI)	*Select status and provide explanation/ supporting background information (e.g., Why is the output delayed?*

Indonesia Coral Triangle Initiative (CTI) zone Indicator(s): Corals database of Indonesia CTI region	region of Indonesia i.e; Nusa Penida-Lombok Strait (Bali), Bunaken (North Sulawesi), Selayar islands (South Sulawesi) and Lombok (West Nusa Tenggara). All samples were collected underwater using pneumatic drill. Total samples are 26 cores with the length varied from 0.5 m to 2.5 meter. All samples have been x-ray radiographed for determining the age and linear extension rates. Based on the x-ray images, mostly all corals have reduced linear extension rates due to increasing Sea Surface Temperature (SST) related to climate change. Some of coral samples show that linear extension rates reduced significantly during the El-nino events. One coral core (20 cm from top) from Nusa Penida, Bali has been analyzed for stable isotopes (O-18 and C-13) using IRMS (Isotopes Ratio Mass Spectrometer) and ratio Sr/Ca and Mg/Ca using ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometer) during the Fellowship (FE INS12020) in Hokkaido University, Japan. The purpose of FE was the methodology of determining stable isotopes and trace elements in coral related to climate change (SST and Salinity). For supporting the research, several sediments core near the coral locations have been collected and analyzed the sedimentation rates using environmental isotope Pb-210 with the equipment alpha spectrometers (EQ from the Project). Meanwhile, ICP-OES (EQ from the Project) has been calibrated and tested and it will be used for analyzing trace elements Ca and Sr related to climate change for all samples from CTI region of Indonesia.	
Output 2: Human resources development and dissemination of nuclear application in marine science Indicator(s): Indonesian team is technically trained.	☐ Completed ☒ On schedule ☐ Delayed ☐ Other (specify) [Provide explanation] Human resources development is related to the FE, SV and EM. FE INS12020 has been conducted in the Department of Natural History Sciences, Hokkaido University supervised by Dr Tsuyoshi WATANABE. The topic of FE is methodology in analyzing and data interpretation of coral core using X-ray radiography for anual banding, Isotop Ratio Mass Spectrometer (IRMS) for O-18 and Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES) for trace element Ca, Sr and Mg. The FE was conducted succesfully and all techniques are ready to use in the laboratory for conducting the climate change research. Moreover, the equipments ICP-OES and its supporting are now available in the lab which are provided by the Agency. FE INS12015 was conducting succesfully in Institute for Environmental Research, ANSTO supervised by Prof Dr Henk Heijnis. The FE focused on dating techniques using Pb-210 in coral and sediment samples and also trace elements. These techniques are important for study past time change in the climate and environment. The equipments alpha spectrometers provided by Agency through this Project has been used for climate as well as environmental change. SV INS11029 and INS12018 have been done in relation with the FE 12020 and FE 12015.	

	Five EMs have been received.	
Output 3: High temporal resolution corals monitoring system Indicator(s): Better understanding the roles of corals as high temporal resolution recorder of climate change	☒ Completed ☐ On schedule ☐ Delayed ☐ Other (*specify*) [Provide explanation] Through the EMs, FE and SV, it has been studied in understanding the role of corals in recording high temporal resolution. EMs has been received for workshops which related to the climate changes. FEs and SVs were also conducted to study the methodologies in analyzing coral samples by IRMS (stable isotopes) and ICP-OES (ratio Sr/Ca and Mg/Ca) for monthly resolution of the fluctuation of SST and Salinity related to climate change.	
Output 4: ... Indicator(s): ...	☐ Completed ☐ On schedule ☐ Delayed ☐ Other (*specify*) [Provide explanation]......	*Insert additional rows if more than 4 outputs*

SECTION-3: EQUIPMENT & HUMAN RESOURCES

Based on TC Input categories, rate overall contribution towards achievement of project Outputs of Procurement and Human Resources capacity building Activities implemented thus far

Equipment (EQ)/ Sub-Contract (SC)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] All the requested equipments (for fieldwork and laboratory analysis) have been delivered on schedule and have been used for conducting the research for implementation of the project. For the equipments which are received in 2012 and 2013, they have been used in the lab as well as in the field regularly. For 2014, ICP-OES has been installed and tested including calibration. Now, this equipment is run for conditioning before analyzing coral samples which are collected from sampling sites in CTI region, i.e; Lombok strait (Bali), Bunaken (North Sulawesi), Selayar (South Sulawesi) and Lombok (West Nusa Tenggara). In 2015, the request for EQ is Water purification. It has been agreed and processed in the Agency and will be delivered soon.	*Select overall rating and provide explanation/ supporting background information deemed relevant to support rating* *(e.g., Is the procured EQ on schedule as regards delivery/ custom clearance/ installation-commissioning/ utilization? If not, what is being done to overcome difficulties?* *How did/ will the training received through FEs/ SVs support the establishment of new services? Are the trainees still employed?*
Expert Missions (EM)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] Experts have assisted the project and team members in conducting the project. The supports from the experts were in the laboratorium (methods, analysis and data interpretation) and the national seminars. The communication with the experts are still continuing regarding the project and plan to do a collaboration in conducting research using coral samples from Indonesia.	*How did/ will the technical guidance received during/after EMs help improve capabilities of the Counterpart Institute?* *Was/will the knowledge and*

Fellowships (FE)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] The programmes of training were very good for both INS12020 and INS12015. INS12020 studied the methodology in analyzing coral sample using IRMS (analyzing O-18) and ICP-OES (analyzing Sr/Ca ratio) for SST and Salinity reconstruction related to climate change. INS12015 studied dating techniques together with analyzing heavy elements in coral and sediment. Both FEs are now being used in the lab for analyzing coral and sediment for the climate change research. These methods will be used for next research since climate change project has been approved for the next cycle (5 years). These methods also will be applied using new ICP-OES and other equipments which have been provided by the Agency through this project.	*experience gained by TC/ WS participants shared/ be shared among colleagues to enhance institutional performance? How was/ will this done/ be done?)*
Scientific Visits (SV)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] SV INS11029 and INS12018 are in connection with the FEs since the SVs were conducted at the same lab with the FEs.	
National Training Courses (TC)	☒ Not Applicable ☐ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation]......	
Meetings (MT)/ Workshops (WS)	☒ Not Applicable ☐ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation]......	

SECTION-4: COMMENT AND RECOMMENDATIONS BY CP

Rating by CP	The project performance: ☐ Very Good ☒ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]...... Project is conducted in accordance with the Project Strategy such as survey, sampling, monitoring and data interpretation. Collaboration between two institutes (BATAN and Institute of Marine Research and Observation) and supported by Geo-technology Research Center of Indonesian Institute of Sciences for conducting the research is good, and also the support from the IAEA experts for the implementation of this project and for future collaboration. The support received from the Agency: ☒ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]...... The support from IAEA is very good in the arrangement of all requests for EQ, SV, EM and FE. All the equipments which are provided by the Agency are being used and very useful for the project and can be utilized for future research. The arrangements for FEs and SVs were also suitable with the need to study corals for climate change research.	*Select rating based on experience thus far and provide explanation/ supporting background information deemed relevant to support rating*
Lessons learned	The establishment of collaboration for conducting research within national Project team and the support from IAEA and experts. This collaboration can be	*Highlight key factors of success / failure that can promote/ hinder the achievement of*

	continued on the same subject (climate change) for other areas in CTI and Indonesian Through Flow to better interpretation and understanding of climate change in Indonesia. The equipments (EQs) as well as the trainings (FEs and SVs) which are provided by IAEA can support our future research in Indonesia. More supports are received from Indonesian Government since the research is conducted by collaboration of amongst national research institutes and IAEA including developed countries (experts).	*project outputs and may impact TC Programme delivery*
Recommendatio n(s) by CP to:	☒PMO. To increase the capablities, it is needed to involve in the International research group of climate change; hopefully Agency can provide the information and recomendation to participate in the groups. ☒TO. To expand on climate change research, hopefully TO can recommend Indonesia to participate in the new IAEA-CRP on climate change. The expertise in conducting research and analyzing sample for IRMS (stable isotopes) are needed which can be available in the CRP. ☒NLO/Government. The continuation of the support from Indonesian government to establish the climate change research. This research is important for Indonesia in relation with its location is vulnerable to climate change. ☐CP Management ☐Other (specify)	*Select addressee and provide recommendation(s) to be addressed*
SECTION-5: OUTCOME PROGRESS: (1ˢᵗ column prefilled)		
Outcome Statement The better understanding of high temporal resolution proxy climate records on corals and its associative environment system within Indonesia CTI (Coral Triangle Initiative) region. Outcome Indicator Development of scientific and technical analysis of isotopic technology of atmospheric-oceanic process.	☐ Achieved ☒ To be achieved as planned (on schedule) ☐ Delayed ☐ Other (*specify*) [Provide explanation]...... In accordance with the implementation of the project, it has been achieved the outputs i.e; past climate change information (annually) and database from the coral in the CTI region, the capabilities of researchers from the FEs and SVs together with the support from the EMs for conducting the research, the facilities in the lab from the EQs. The basic of the research on climate change has been conducted, and it will be developed in the next research in order to cover all the region in the CTI as well as ITF for better data interpretation of the application of nuclear technologies in climate change in Indonesia. National programme has been approved for next 5 years for conducting this research which will be done through the collaboration of national research institutes in Indonesia. In addition, 3 students have finalised their studies on post graduate using the facilities as well as the technologies from the Project. Participation in the IAEA regional Asia Pasific Project IAEA RCA RAS/7/024 (climate change) has increase the capabilities of Indonesia in the regional level as a result of this national TC Project.	*Select status and provide explanation/ supporting background information (e.g., based on the outcome indicator and its target value, to what extent the outcome is being achieved? Is there any deviation from expectations? Why?)*

	SECTION-6: CLEARANCE BY NLO		
Clearance by NLO	July 29, 2015		*Day, Month and Year*
	The project has been showed to value in providing information for environmental future programme, particularly for local national project in monitoring climate change impact in Indonesia. The benefit of this project is also can be monitored by which one of the counterpart project origins from Ministry of Marine and Fisheries. TC Project contribution also has been showed to impact in the ca[acity building improvement to the personnels involved in this project, where involving personnel from other institutions. The collaboration harmony amongs national and international institution has also been showed in this project activity. Finally, support from other International Agency is also required to continue this programme activity with the purpose of exchange information and expertise either within the region or other region.		*Provide any additional remark deemed relevant*

	SECTION-7: FEEDBACK BY IAEA ON THE REPORT	
Comments by TO(s)	☐ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]……	*Rating and feedback from TO(s) **on the report***
Comments by PMO	☐ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]……	*Rating and feedback from PMO(s) **on the report***

[1]**CP**: Counterpart
[2]**NLO**: National Liaison Officer
[3]**PMO**: Programme Management Officer
[4]**TO**: Technical Officer

II. Laporan kemajuan (PPAR) periode Juli 2015-Desember 2015

PROJECT PROGRESS ASSESSMENT REPORT (PPAR)
National Projects

II.   Laporan kemajuan (PPAR) periode Juli 2015-Desember 2015

PROJECT PROGRESS ASSESSMENT REPORT (PPAR)
National Projects

		Explanations
SECTION-1: BASIC INFORMATION		
Project Number and Title	INS7006, Applying Nuclear Technologies to Enhance Climate Change Research and Support an Observation Plan for Corals	
Country	INDONESIA	
Counterpart Name & Institution	1. Mr. Ali Arman Center for Isotopes and Radiation Application National Nuclear Energy Agency Indonesia-BATAN 2. Mr. Agus Setiawan Institute of Marine Research and Observation Ministry of Marine Affair and Fisheries Indonesia	*(Prefilled)*
1st Year of Approval	2011	
Estimated Duration	4 years	
Expected End Date	30-12-2015	
Total Project Budget *(as per IAEA White Book)*	EBT-USA06-11-02: €106,288.00 EBT-USA01-12-04: €188,370.00 Total : €294,658.00	
Reporting Period	January - June 2015 ☒ July – December 2015	*Tick one reporting period*
Report Contributors		*Other contributors to the report besides counterpart*
Has there been any major change that affected the project?	☐ Yes ☒ No If yes, tick to specify nature of change(s): ☐ CP[1] ☐ NLO[2] ☐ PMO[3] ☐ TO[4] ☐ Budget/funding; ☐ Other *(specify)* [Provide explanation]......	*Select "Yes" or "No" and, if "Yes", please tick relevant box(es) and describe nature of impact*
SECTION-2: OUTPUTS ACHIEVEMENT		
Select status of Output and briefly describe elements of progress towards target indicators: (1st column prefilled)		
Output 1: Climate change evidence information & database on corals of Indonesia Coral Triangle Initiative (CTI) zone Indicator(s): Corals database of Indonesia CTI	☒ Completed ☐ On schedule ☐ Delayed ☐ Other *(specify)* [Provide explanation] Massive corals of *Porites Lutea, Porites Lobata* and *Diploastrea Heliopora* have been collected from the Coral Triangle Initiative (CTI) region of Indonesia i.e; Nusa Penida-Lombok Strait (Bali), Bunaken (North Sulawesi), Selayar islands (South Sulawesi) and Lombok (West Nusa Tenggara). All samples were collected underwater using pneumatic drill. Total samples are 26 cores with the length varied from 0.5 m to 2.5 meter. All samples have been x-ray radiographed for determining the	*Select status and provide explanation/ supporting background information (e.g., Why is the output delayed? What mitigation measures have been taken to solve the issue?)*

region	age and linear extension rates. Based on the x-ray images, mostly all corals have reduced linear extension rates due to increasing Sea Surface Temperature (SST) related to climate change. Some of coral samples show that linear extension rates reduced significantly during the El-nino events. One coral core (20 cm from top) from Nusa Penida, Bali has been analyzed for stable isotopes (O-18 and C-13) using IRMS (Isotopes Ratio Mass Spectrometer) and ratio Sr/Ca and Mg/Ca using ICP-OES (Inductively Coupled Plasma-Optical Emission Spectrometer). These analysis were conducted during the Fellowship (FE INS12020) in Hokkaido University, Japan. The purpose of FE was the methodology of determining stable isotopes and trace elements in coral related to climate change (SST and Salinity). For supporting the research, several sediments core near the coral locations have been collected and analyzed the sedimentation rates using environmental isotope Pb-210 with the equipment alpha spectrometers (EQ from the Project). Meanwhile, ICP-OES (EQ from the Project) has been used for analyzing trace elements (Ca, Sr, Mg, Ba, Ag, Al, Cu, Cr, Fe, Se, Pb, Mn, Ni) in the coral skeleton. These trace elements were sub-sampled from anual banding of the coral skeleton. More work will be done in analyzing coral skeleton for interpretation of climate change as well as pollution history in the CTI region of Indonesia.	
Output 2: Human resources development and dissemination of nuclear application in marine science Indicator(s): Indonesian team is technically trained.	☐ Completed ☒ On schedule ☐ Delayed ☐ Other (*specify*) [Provide explanation] Human resources development is related to the FE, SV and EM. FE INS12020 has been conducted in the Department of Natural History Sciences, Hokkaido University supervised by Dr Tsuyoshi WATANABE. The topic of FE is methodology in analyzing and data interpretation of coral core using X-ray radiography for anual banding, Isotop Ratio Mass Spectrometer (IRMS) for O-18 and Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES) for trace element Ca, Sr and Mg. The FE was conducted succesfully and all techniques are ready to use in the laboratory for conducting the climate change research. Moreover, the equipments ICP-OES and its supporting are now available in the lab which are provided by the Agency. FE INS12015 was conducted succesfully in Institute for Environmental Research, ANSTO supervised by Prof Dr Henk Heijnis. The FE focused on dating techniques using Pb-210 in coral and sediment samples and also trace elements. These techniques are important for study past time change in the climate and environment. The equipments alpha spectrometers provided by Agency through this Project has been used for climate as well as environmental change. FE INS12014 for Ms Camellia TITO is planned to conduct on January 2016 in IAEA MEL-Monaco, however the candidate has requested to the Agency to postpone due to the candidate that just started her study in University. SV INS11029 and INS12018 have been done in relation with the FE 12020 and FE 12015. Five EMs have been received.	

Output 3: High temporal resolution corals monitoring system Indicator(s): Better understanding the roles of corals as high temporal resolution recorder of climate change	☒ Completed ☐ On schedule ☐ Delayed ☐ Other (*specify*) [Provide explanation] Through the EMs, FE and SV, it has been studied in understanding the role of corals in recording high temporal resolution. EMs has been received for workshops which related to the climate changes. FEs and SVs were also conducted to study the methodologies in analyzing coral samples by IRMS (stable isotopes) and ICP-OES (ratio Sr/Ca and Mg/Ca) for monthly resolution of the fluctuation of SST and Salinity related to climate change.	
Output 4: ... Indicator(s): ...	☐ Completed ☐ On schedule ☐ Delayed ☐ Other (*specify*) [Provide explanation]......	*Insert additional rows if more than 4 outputs*

SECTION-3: EQUIPMENT & HUMAN RESOURCES

Based on TC Input categories, rate overall contribution towards achievement of project Outputs of Procurement and Human Resources capacity building Activities implemented thus far

Equipment (EQ)/ Sub-Contract (SC)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] All the requested equipments (for fieldwork and laboratory analysis) have been delivered on schedule and have been used for conducting the research for implementation of the project. For the equipments which are received in 2012 and 2013, they have been used in the lab as well as in the field regularly. For 2014, ICP-OES has been installed and tested including calibration. Now, this equipment is run for analyzing coral samples which are collected from sampling sites in CTI region, i.e; Lombok strait (Bali), Bunaken (North Sulawesi), Selayar (South Sulawesi) and Lombok (West Nusa Tenggara). Several trace elements has been analyzed in the anual band of skeleton for geochronology pollutions. In 2015, the request for EQ is Water purification. The PO of this EQ has been received (PO 201504030-MN rev.3) and now on the process of delivery to the lab.	*Select overall rating and provide explanation/ supporting background information deemed relevant to support rating* *(e.g., Is the procured EQ on schedule as regards delivery/ custom clearance/ installation-commissioning/ utilization? If not, what is being done to overcome difficulties?* *How did/ will the training received through FEs/ SVs support the establishment of new services? Are the trainees still employed?* *How did/ will the technical guidance received during/after EMs help improve capabilities of the Counterpart*
Expert Missions (EM)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] Experts have assisted the project and team members in conducting the project. The supports from the experts were in the laboratorium (methods, analysis and data interpretation) and the national seminars. The communication with the experts are still continuing regarding the project and plan to do a collaboration in conducting research using coral samples from Indonesia.	

Fellowships (FE)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] The programmes of training were very good for both INS12020 and INS12015. INS12020 studied the methodology in analyzing coral sample using IRMS (analyzing O-18) and ICP-OES (analyzing Sr/Ca ratio) for SST and Salinity reconstruction related to climate change. INS12015 studied dating techniques together with analyzing heavy elements in coral and sediment. Both FEs are now being used in the lab for analyzing coral and sediment for the climate change research. These methods will be used for next research since climate change project has been approved for the next cycle (5 years). These methods also will be applied using new ICP-OES and other equipments which have been provided by the Agency through this project.	*Institute? Was/will the knowledge and experience gained by TC/ WS participants shared/ be shared among colleagues to enhance institutional performance? How was/ will this done/ be done?)*
Scientific Visits (SV)	☐ Not Applicable ☒ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation] SV INS11029 and INS12018 are in connection with the FEs since the SVs were conducted at the same lab with the FEs.	
National Training Courses (TC)	☒ Not Applicable ☐ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation]......	
Meetings (MT)/ Workshops (WS)	☒ Not Applicable ☐ Very Good ☐ Good ☐ Fair ☐ Poor [Provide explanation]......	

SECTION-4: COMMENT AND RECOMMENDATIONS BY CP	

Rating by CP	The project performance: ☐ Very Good ☒ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]...... Project is conducted in accordance with the Project Strategy such as survey, sampling, monitoring and data interpretation. Collaboration between two institutes (BATAN and Institute of Marine Research and Observation) and supported by Geo-technology Research Center of Indonesian Institute of Sciences for conducting the research is good, and also the support from the IAEA experts for the implementation of this project and for future collaboration. The support received from the Agency: ☒ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]...... The support from IAEA is very good in the arrangement of all requests for EQ, SV, EM and FE. All the equipments which are provided by the Agency are being used and very useful for the project and can be utilized for future research. The arrangements for FEs and SVs were also suitable with the need to study corals for climate change research.	*Select rating based on experience thus far and provide explanation/ supporting background information deemed relevant to support rating*
Lessons learned	The establishment of collaboration for conducting research within national Project team and the support from IAEA and experts. This collaboration can be continued on the same subject (climate change) for other areas in CTI and Indonesian Through Flow to better	*Highlight key factors of success / failure that can promote/ hinder the achievement of project outputs*

	interpretation and understanding of climate change in Indonesia. The equipments (EQs) as well as the trainings (FEs and SVs) which are provided by IAEA can support our future research in Indonesia. More supports are received from Indonesian Government since the research is conducted by collaboration of amongst national research institutes and IAEA including developed countries (experts).	*and may impact TC Programme delivery*
Recommendation (s) by CP to:	☒PMO. To increase the capablities, it is needed to involve in the International research group of climate change; hopefully Agency can provide the information and recomendation to participate in one of the groups. ☒TO. To expand on climate change research, hopefully TO can recommend Indonesia to participate in the new IAEA-CRP on climate change. The expertise in conducting research and analyzing sample for IRMS (stable isotopes) are needed which can be available in the CRP. ☒NLO/Government. The continuation of the support from Indonesian government to establish the climate change research. This research is important for Indonesia in relation with its location is vulnerable to climate change. ☐CP Management ☐Other (specify)	*Select addressee and provide recommendation(s) to be addressed*

SECTION-5: OUTCOME PROGRESS: *(1st column prefilled)*

Outcome Statement The better understanding of high temporal resolution proxy climate records on corals and its associative environment system within Indonesia CTI (Coral Triangle Initiative) region. **Outcome Indicator** Development of scientific and technical analysis of isotopic technology of atmospheric-oceanic process.	☐ Achieved ☒ To be achieved as planned (on schedule) ☐ Delayed ☐ Other (*specify*) [Provide explanation]...... In accordance with the implementation of the project, it has been achieved the outputs i.e; past climate change information (annually) and database from the coral in the CTI region, the capabilities of researchers from the FEs and SVs together with the support from the EMs for conducting the research, the facilities in the lab from the EQs. The basic of the research on climate change has been conducted, and it will be developed in the next research in order to cover all the region in the CTI as well as ITF for better data interpretation of the application of nuclear technologies in climate change in Indonesia. National programme has been approved for next 5 years for conducting this research which will be done through the collaboration of national research institutes in Indonesia (Ministry of Marine Affairs, Bogor Agricultural University, University of Brawijaya, Diponegoro University and Sriwijaya University). In addition, 5 post graduate students have finalised their studies using the facilities as well as the technologies from the Project. Participation in the IAEA regional Asia Pasific Project IAEA RCA RAS/7/024 (climate change) has increased the capabilities of Indonesia in the regional level as a result of this national TC Project.	*Select status and provide explanation/ supporting background information (e.g., based on the outcome indicator and its target value, to what extent the outcome is being achieved? Is there any deviation from expectations? Why?)*

SECTION-6: CLEARANCE BY NLO

Clearance by NLO	January 7th, 2015	*Day, Month and Year*
	Project of Applying Nuclear Technologies to Enhance Climate Change Research and Support an Observation Plan for Corals in Indonesia, has shown that collaboration several institutions is the key role in the mitigation of global change. There is no doubt that the coordination among institution involved in this Project is due to the on-going IAEA National TC Project, where scheduled coordination and expert mission for knowledge Exchange had been made. It is expected, after Project termination, working network among institutions involved in this project would be still maintained.	*Provide any additional remark deemed relevant*

SECTION-7: FEEDBACK BY IAEA ON THE REPORT	

Comments by TO(s)	☐ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]......	*Rating and feedback from TO(s) on the report*
Comments by PMO	☐ Very Good ☐ Good ☐ Fair ☐ Poor ☐ Very Poor [Provide explanation]......	*Rating and feedback from PMO(s) on the report*

[1]CP: Counterpart
[3]PMO: Programme Management Officer

[2]NLO: National Liaison Officer
[4]TO: Technical Officer