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ROSETTA

Rosetta Payload Passive Checkout 0 Report

RO-EST-RP-3318

Issue 2 Rev.a

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Modified by: V.J.F. Dhiri

Created by: V.J.F. Dhiri

Approved by: D.Koschny

CHANGE RECORD SHEET

Date	Iss.	Rev.	pages	Description/Authority	CR No.
02May05	D	-	All	Initial Release	
16May05	1	-	All	Updated all sections as a result of PC telecon#4 and inputs from PI teams.	
01Jul05	1	1	All	Editorials	
			DL	Updated CS PI	
			1.4	Added references.	
			T2	Added references to reports.	
			T3	Updated	
			T4	Continues resources analysis	
19Jul05	2	-	All	TBD's updated.	
			1.4	Added power budget reference.	
			T4	Continued resources analysis	
			T5	Added for analysis clarity.	
			6	added a section for overall conclusions	
02Nov05	2	a	1.4	Added ref to Open issues doc	
			1.4	Updated RD03 to be on-going.	
			T4	corrected AL/CS	
			T4	Added peak power values	
			T2	Updated RSI results.	
			T2	Add details for CS	
			T2	Updated details for MR.	
			T3	Removed AR Status Column	
			3	Added ref to Open issues doc	
			4.2	Event Driven POR has been tested.	
			6	Added reference to OOL/Events analysis	
			T4	RPC Evaluation added	
			T5	RPC Evaluation added	

Issue to issue revisions are indicated by a vertical bar at the outside border.

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1. General Remarks

1.1 Summary

Passive Checkout 0 completed and this first iteration ran smoothly for most teams. One major mishap occurred with MIDAS due to mis-interpretation of default values called. Instrument operations were also missing some sequences that were detected by RMOC before execution.

Payload activities during Passive Checkout 0 are summerised in this report. Anomalies, Events and OOL detected during PC0 operations are also reported and tracked. Subsequent investigations are tracked including reference to AR's that have been raised and other reports. Science achieved by each team is summerised with a view of the initial High Level requirements listed in the MSP. P/L Team reports shall be referenced.

1.2 PC Details

The following table gives PC0 dates.

Table 1 : Passive Checkout #0

Begin	End	Comments
DOY086:27MAR05	DOY090: 31MAR05	Rosetta Passive Checkout #0 (4d) Ends at 00:00:00 on DOY090 hence 4d

1.3 Applicable Documents

AD01 RO-EST-PL-3301_2_1_MSP_Passive_Checkout_2005MAR19.pdf

AD02 Rosetta/Mars Express Mission Control System Command Request Interface Document CRID; RO-ESC-IF-5004; IssueB5; 09OCT2003

1.4 Reference Documents

RD01 Rosetta Project Glossary, RO-EST-LI-5012, http://www.rssd.esa.int/index.php?project=ROSETTA&page=glossary.

RD02 RO-EST-RP-3346_1_a_Rosetta_Payload_Open_Issues_Report_2005NOV03

RD03 RO-EST-LI-3326_PL_OOL_Events_Investigation.xls. On-Going

RD04 MID-IWF-TN-0090_1__Report on the Active Checkout of MIDAS on 19th April 2005; 2005APR26

RD05 Anomaly report ROS_SC-88

RD06 COSIMA_PC0_report_2005.pdf

RD07 RO-ESC-RP-5018_1_-_Mission_Operations_Report_#38_Earth_Swing-by_1_2005Mar11.pdf

RD08 RO-ESC-RP-5018_1_-_Mission_Operations_Report_#39_2005Mar25.pdf

RD09 RO-ESC-RP-5018_1_-_Mission_Operations_Report_#40_2005Apr08.pdf

RD10 RO-DSS-RP-1015_6_-_Power_Budget_RP.doc; 2002JUL27

RD11 RO-RPC-OR-9002-Rosetta PIU Passive Checkout 0 Report

RD12 IRFU-ROS-OPR-PC0; Rosetta RPC-LAP Operations Report Passive Checkout 0

RD13 10991-IESODCP-01; Report on results of RPC-IES operations during Rosetta Passive Checkout 0 (PC0), March 29, 2005

RD14 RO-RIS-MPAE-RP-157; OSIRIS passive checkout No. 0; Issue: 1; 13 September 2005

RD15 Philae_Passive Checkout_0_RP.pdf

2. Scientific Return

Table 2 compares the high level requirements (table 4 in the PC0 MSP AD01) for PC0 with the reported results. References to results reports are also given.

Table 2: High Level Requirements vs Results

OBS	Description	Objective	Results	Ref.
AL	6-Months Status check	Health Check: • Self Test • Memory Check • Dark Exposures • etc.	Objectives were updated before execution as follows: Dark Exposures were not run as intended. A test pattern and stim test was performed. Self Test included electronics and software verification. ========== All PC operations completed successfully with no change in instrument performance. ========== AL have looked at the returned instrument and relevant spacecraft data from the passive checkout #0 including temperatures, checksums, results of thee self test, parameter values, end state (door closed and Alice OFF), and all are as expected. AL have developed a summary checklist that members of the team will use to make sure that all data are reviewed after each passive checkout, and an extensive spreadsheet that logs the detailed data.	None

OBS	Description	Objective	Results	Ref.
CN	6-Months Status check	• Instrument Verification/setUP in 3 steps : • Consert Orbiter Verification • Consert Lander Verification • Consert Orbiter/Lander Time Synchronisation	• No Input	No Input
CS	Periodical maintenance and status check	• Self-check • Target manipulator unit maintenance • Ion emitter maintenance.	• subsystems OK • TMU relay error, error to be cleared in contingency operations • emitter A showed known not nominal behavioud, emitter C is ok	RD06
GD	6-Months Status check	• Run Mechanisms - cover operations • Health Check - all subsystems and electronics functional verifications, noise and contamination monitoring, performances estimation	• Stray light issues saturated required data. • Investigation continues.	None

OBS	Description	Objective	Results	Ref.
LZ	6-Months Status check	• Tests of the Lander platform to check the overall performance and Secondary Battery status • Short function tests of some Lander experiments: • Lander Extended AFT • Secondary Battery Monitoring • CDMS EEPROM dump • Separate short functional tests for PTOLEMY and CONSERT	• The Passive Checkout #0 was executed as planned, all subsystems and experiments showed nominal behaviour. • More details in reference.	RD15
MD	Check-out and mechanism activation	• Regular health check and exercising of all mechanisms (shutter, approach mechanism, linear stage, wheel, scanner)	Operations failed due to incorrect handling of command parameters by the system.	RD04
MR	6-Months Status check	• Regular exercise and health check of all commands in all modes. • Regular dump of EEPROM memory to check for radiation damage.	• (first half: AMRF100A). This is pending, waiting for completion of software for automated analysis of this test. We do know that some of the timings of this sequence will be increased, but not by large amounts. Already noted in MSP. • EEPROM memory dump to check for radiation damage: This check has been promptly done for every execution so far of AMRF101A, and has always yielded a positive result (no sign of damage).	None

OBS	Description	Objective	Results	Ref.
RP	Status check and instruments calibration	• MAG: Instrument calibration. Passive checkout phase offers a precious opportunity to measure undisturbed solar wind. Such data will be used to calibrate the offsets of the MAG instrument in quiet conditions using, for instance, the Hedgecock method. This method can not be applied at any time since special solar wind conditions have to be fulfilled. • LAP: Instrument calibration. • MIP: Instrument checkout. • IES: IES to make measurements in the undisturbed solar wind (that is, away from planets, etc.) for calibration of its sensors and cross calibration with LAP. Would like to operate for as long as possible.	• PIU: Report title: RO-RPC-OR-9002-Rosetta RPC-PIU Passive Checkout 0 Report LAP: Report title: Rosetta RPC-LAP Operations Report Passive Checkout 0 (IRFU-ROS-OPR-PC0) • MIP: Report title: MIP Passive Checkout 0 report • MAG: "All PC operations completed successfully with no change in instrument • performance" • IES: Report title: Report on results of RPC-IES operations during Rosetta Passive Checkout 0 (PC0), March 29, 2005, 10991-IESODCP-01". • ICA: Did not take part.	RD11 RD12 RD13
RS	two frequency downlink (non coherent) driven by the USO and a ground station that can receive the X- and S-band signals	• Investigate the stability of the USO and verify interaction with the ground.	• All PC operations completed successfully with good data. • Deeper investigations of the USO data revealed that the behaviour of the USO is obviously not as good as it was during the last USO test in October. Investigation on going.	None

OBS	Description	Objective	Results	Ref.
SR	6-Months Status check	• exercise the instrument mechanisms • verify the sanity of the CCD • verify the focus of the instrument.	• Considering front door mechanisms were not tested (AD01) all main objectives were achieved with nominal results. • 1 issue with NAC CCD refer to SR report.	RD14
VR	6-Months Status check	• No Input	• No Input	No Input

Note: ROSINA did not take part in PC0

3. Payload Operations

All reported issues that impact payload operations, generated during the scenario are listed here. All issues are tracked in RD02 and RD03 giving the status of issues generated in this and all previous scenarios.

3.1 RMOC Reported Anomalies, Events & OOL

All Events and OOL encountered during the scenario are listed and tracked in RD03. Table 3 indicates the number of items opened during this scenario and associated AR.

Table 3: EVENTS & OOL STATUS

INST	EVENTS	OOL	AR
AL	-	-	-
CS	2	-	-
GD	-	17	-
LZ	2	10	-
MD	7	1	RD05
MR	-	9	-
RP	-	5	-
VR	-	3	-

3.1.1 MIDAS

Anomaly - an emergency switch-off was instigated during MD operations. An over current was reported. Later investigation concluded that default engineering values passed to RMOC via the POR were translated incorrectly as RAW values to the MIDAS instrument. Subsequent operations of MIDAS were cancelled.

Actions - An active checkout was carried out on the 19th April and the results are reported in RD04.

Conclusion - "Instrument remains fully operational and was not harmed by the events during Passive Checkout 0". All teams asked to not used default engineering values. Investigation continues at RMOC. More comments in section 3.2.

3.1.2 LANDER

Anomaly - RMOC detected that Consert/Lander ops called a CVP procedure which required manual insertion of Consert switch on/off. This was expected to be done via OBCP. As the flight rule is to use OBCPs after commissioning, commanding was updated manually trying to respect the timing of CV-FCP-254.

Actions - Changes were verified by LCC and the Consert team. The changes were as follows:

Removed from Timeline:

ZDMX0052 089.00.00.02

ZDMX0063 089.00.00.04

ZPWMA111 089.00.00.10

ZDMX0215 089.00.00.50

ZDMX0226 089.00.01.10

ZPWMA112 089.00.18.10

ZDMX0052 089.00.20.10

ZDMX0063 089.00.20.12

Inserted into Timeline:

ACNF011A - START CONSERT ON OBCP 089.00.00.05

ACNF012A - START CONCERT OFF OBCP 089.00.18.10

Conclusion - These changes are noted for PC_1. LOR updated to remove cmds and include sequences.

3.1.3 CONSERT STANDALONE

Anomaly - RMOC detected that the CONSERT standalone operations called for a procedure which required manual insertion of the Consert switch on/off. The relevant OBCP calls were therefore inserted.

Actions - Changes were verified by the Consert team. The changes were as follows:

Inserted into Timeline:

ACNF011A - START CONSERT ON OBCP	088.18.30.00
ACNF001A - Mission table update	088.18.35.00
ACNF012A - START CONCERT OFF OBCP	088.19.30.00

Conclusion - These changes are noted for PC_1. Missing sequences are to be added to the PC timeline. (ACNF011A and ACNF012A)

3.1.4 OSIRIS

Anomaly - RMOC detected that OSIRIS CCD Decontamination Heaters were automatically switched off at the beginning of SR operations but were not commanded on again after operations. This switch on commands need to be inserted by RMOC and cannot be included in the POR file. This has been implemented to keep check on power usage by RMOC. It is understood that the MSP should have contained a specific request to have these heaters switched back on. Note: These heaters should not be mixed up with the structure Non-Ops heaters that can be switched on/off via.OBCP.

Actions - Changes were verified by the OSIRIS team. The changes were as follows:

Inserted into Timeline:

ATSF050C - OSIRIS M Decont ON	089.20.55.00
ATSF050D - OSIRIS R Decont ON	089.21.05.00

Conclusion - A request for this RMOC action shall be added in section 7 of the new PC MSP.

3.2 RSOC Reported Anomalies

3.2.1 Use of Default Formal Parameters

Anomaly - Engineering default formal parameters were requested my MD team as described in the CRID (AD02). They were misinterpreted in the ESOC system and assumed as raw values resulting in and emergency switch off of their instrument (more in section 3.1.1). This is applicable to all teams.

Actions - all PI teams were made aware of the situation and ask to A) check all operations since launch to verify the non use of engineering default values. B) to ensure that all formal parameters called are explicitly described in the operations requests if (a) the default value has type ENG, or (b) there is no default value, i.e. Default values of type RAW need not be defined explicitly.

Conclusion - only MD of all the teams are in the habit of using default values.

3.3 PI Reported Anomalies

3.3.1 COSIMA

Anomaly - There was an error in the TMU operations, which did not generate an 5,4 error event due to low level nature of the test done. The error state must be cleared before any future operations with a separate contingency sequence (already sent to RSOC). Otherwise any future high level TMU operation would be stopped with the 5,4 error event.

Actions - a new contingency sequence has been requested ACSS210B. The execution of this sequence should be scheduled before PC1, just COSIMA on, ACSS210B, COSIMA off. A formal request was submitted.

Conclusion - TMU reset was performed successfully on 27th June 2005. TMU error flags were reset to 0 as expected

3.3.2 RPC

Anomaly - A problem with LAP was discovered during PC0. This problem affects particularly the last part of LAP PC and has to be solved before PC1.

Actions - Two solutions are identified to solve the problem: a software patch or an OBCP modification. The software patch is preferred by ESOC (cleaner process). Outstanding activities: the pass could also be used to patch ICA and IES.

Conclusion - Software patch was performed successfully on the 1st June. OBCP 8096 uploaded and tested.

3.3.3 VIRTIS

Anomaly - During the flight activities, we observed a little increase of background on the M-IR detector and we believe that could be due to self

heating of the closest M_VIS detector.

Actions - Update AVRF002C. Switching the PEM ON early results that the M_VIS self heating is already stabilized at the moment

of the observation.

Conclusion - CS_P was provided and new sequences have been created and will be used in PC1.

3.3.4 OSIRIS

Anomaly - An analysis of PC0 showed that there was stray light encountered with the door 'closed'. SR door is never fully closed.

Actions - SR Investigation.

Conclusion - Investigation on-going. It is expected to be solved by a future update to the checkout sequence.

3.3.5 GIADA

Anomaly - Data required was not achieved due to stray light saturating the data.

Actions - GD Investigation.

Conclusion - Investigation on-going.

3.3.6 LANDER

Anomaly - The Secondary Battery shows a continuous discharge, since the balancing circuitry is permanently connected to the cells. The discharge rate measured during PC#0 is higher than one measured during commissioning. The discharge is expected to be stopped by an implemented Zener diode network at a level of 3.3V cell voltage. The critical cell-voltage for Li-Ion batteries is about 2,5V, a lower value
may cause irreversible degradation. With the current discharge rate it is predicted, that the critical level of 2,5V cell voltage could already be achieved before Active Checkout #1.

Actions - Thus additional Battery monitoring cycles are required to exclude PSS main/redundant dependence and to check temperature influence on the measurements. The Lander Team will ask for this activity in the course of PC#1 preparation if applicable.

Conclusion - Operations updated for PC#1.

4. Planning Feedback

4.1 PI Feedback

PI comments on planning process used for PC0 are listed here.

- Lander Operations Request

The Lander Operation Request (LOR) had to be delivered with absolute execution times. During the planning period at RSOC the Lander slot changed several times and the LOR had to be adapted accordingly each time. It is under discussion at RSOC to change to absolute timing to event driven start times for Passive Checkout #1 to gain flexibility and to avoid multiple OR deliveries of the payloads. Also mentioned below.

4.2 RSOC Feedback

RSOC comments on planning process used for PC0 are listed here.

- Repeat/Separation Function GIADA

The repeat/separation function described in the CRID was utilized by the GIADA team. The use of this function in the POR file was not accepted by RMOC and was investigated. The temporary solution that was taken was for RSOC to expand and resolve the file using EPS execute, into a revised input file (timeline.out) before POR creation. Fix: Investigation found that EPS was not creating the correct POR format for this function. EPS have been upgraded to 1.8.1 with patch. Function was tested successfully. Function was used during DI scenario.

- Lander Operations Request

The Philae team delivered a LOR, as standard, containing their PC0 operations with absolute times. Following each iteration on timing the team were obliged to deliver a new LOR. If an event driven LOR could be delivered for PC then re-deliveries would not be necessary in this case. Fix: Event driven LOR has been investigated and tested for use in PC1-n.

4.3 RMOC Feedback

RMOC comments on planning process used for PC0 are listed here.

No comments.

5. Payload Resources Analysis

A comparison with predicted resource usage, EPS simulation and real resource usage. EPS using EDF models as of 03June2005. Real values have been provided by RMOC for Data Volume and from the ESTEC local S2K from derived data on VC1 for the PC0 period.

Legend: After value, ↑ means value has greater then real, ↓ means value has less than real, ↔ means value is equal to real, ? means unknown. Percentage of inaccuracy is also given. Values in bold are closer to real values recorded.

Being within a margin of 20% is considered good enough in the current mission phase.

Table 4: Data Volume and Power Estimates

Team/OBS	Resourses	PI Estimate	EPS	Real	Comments
AL	**HK(MBytes)**	0.04	-	-	• PI estimate is above the 20% margin for both data vol and power. No analysis. • Estimated power value is accurate to that indicated in RD10 (4). • EPS/EDF discussed in next table.
	SCI(MBytes)	0.18 ↑33%	**0.13** **↑8%**	0.12	
	PWR(W)	4.00 ↑22%	**3.66** **↑15%**	3.12 Peak: 3.12	
CN	**HK(MBytes)**				• PI estimate is above the 20% margin for data vol. No analysis. • Estimated power value is accurate to that indicated in RD10 (3.3). • EPS/EDF discussed in next table.
	SCI(MBytes)	0.60 ↑60%	**0.59** **↑59%**	0.24	
	PWR(W)	**3.00** **↑13%**	2.10 ↓20%	2.62 Peak: 2.62	
CS	**HK(MBytes)**	0.23			• PI estimate is above the 20% margin for power. No analysis. • Power peak (26 MBytes) does not explain mismatch. • Estimated power value is lower to that indicated in RD10 (19.5W). • EPS/EDF discussed in next table.
	SCI(MBytes)	**0.24** **↓5%**	4.96 ↑95%	0.009	
	PWR(W)	**16.00** **↑48%**	33.89 ↑75%	8.35 Peak: 9.26	

Team/OBS	Resourses	PI Estimate	EPS	Real	Comments
GD	**HK(MBytes)**	0.80			• PI estimate is above the 20% margin for data vol. No analysis. • Estimated power value is accurate to that indicated in RD10 (20.7). • EPS/EDF discussed in next table.
	SCI(MBytes)	**0.50 ↑78%**	71.00 ↑644%	0.11	
	PWR(W)	20.70 ↑10%	**18.94 ↑2%**	18.64 Peak: 20.63	
LZ	**HK(MBytes)**	0.53 HK (0.13 Evt)			• PI estimate is above the 20% margin for power. No analysis. • 23.4 Peak is not clear in current profile. • EPS/EDF discussed in next table.
	SCI(MBytes)	**1.86 ↔**	N/A	1.86	
	PWR(W)	**10.20 ↓26%**	N/A	13.78 Peak: 19.95	
MD	**HK(MBytes)**	0.82 x 2			• Real data volume and power is not relevant for future checkouts because of the anomaly. (emergency switch off after 1hr of operation) • Estimated power value is lower to that indicated in RD10 (15.7). • PI estimate is current best estimate. • EPS/EDF discussed in next table.
	SCI(MBytes)	**0.02 x 2**	0.08x2	N/A	
	PWR(W)	**8.50 - 13.50**	11.04	13.19	
MR	**HK(MBytes)**	1 HK (0.0002442 acks & reports)			• PI estimate is above the 20% margin for data vol. MR revise their estimate to 2.395. This would bring the discrepancy to ↑9% that is within the 20% margin.

Team/OBS	Resourses	PI Estimate	EPS	Real	Comments
	SCI(MBytes)	**3.00 ↑27%**	0.13 ↓94%	2.19	• Considering peaks (76MBytes) puts the av estimate to high. • Estimated power value is lower to that indicated in RD10 (70.7). • EPS/EDF discussed in next table.
	PWR(W)	**34.00 ↓15%**	49.89 ↑20%	40.01 Peak: 70.11	
RP	**HK(MBytes)**	0.08			• PI estimate is above the 20% margin for power. RP investigating. • Estimated power value is lower to that indicated in RD10 (15.1). • EPS/EDF discussed in next table. • Discrepancy in Data Volume can be due to due to LAP sw bug which caused some 20 min data loss. The bug has been fixed by a patch. (section 3.3.2)
	SCI(MBytes)	1.40 ↑14%	**1.33 ↑10%**	1.20	
	PWR(W)	**5.00 ↓22%**	4.76 ↓26%	6.45 Peak: 6.57	
SE	**HK(MBytes)**				• No EPS/EDF currently. • Estimated power value is accurate to that indicated in RD10 (2).
	SCI(MBytes)	0.71?	N/A	-	
	PWR(W)	2.50?	N/A	-	
SR	**HK(MBytes)**				• PI estimate is above the 20% margin for power. No analysis. • Estimated power value is accurate to that indicated in RD10 (44). • No EPS/EDF currently.
	SCI(MBytes)	**19.10 ↑2%**	N/A	18.71	
	PWR(W)	**40.00 ↑54%**	N/A	18.33 Peak: 39.43	

Team/OBS	Resourses	PI Estimate	EPS	Real	Comments
VR	**HK(MBytes)**				• PI estimate is within the 20% margin for power. • Power estimate averaged for comparison. • Estimated power value is accurate to that indicated in RD10 (53.4). • EPS/EDF discussed in next table.
	SCI(MBytes)	**18.38 ↑6%**	18.48 ↑7%	17.22	
	PWR(W)	**Av.50.5 ↑8%**	43.72 ↓18%	46.70 Peak: 50.78	
Totals	**HK(MBytes)**	**4.46**			Total Data volume was less then expected due to MD emergency shutdown.
	SCI(MBytes)	**46.00**	**41.90**		
	PWR(W)	**176.4**			

Table 5: Payload Resource Analysis

Team	Data Volume	Power Consumption
Estimates	• All HK and Science data was downloaded in the first PC dedicated pass and there was no need for the backup pass. • Due to MD emergency switch-off total data vol was not as expected. • Most instruments overestimated their data vol.	• 3/11 teams underestimated their power consumption. • peaks can explain several discrepancies. • comparison with profiles would be useful in a deeper analysis. • RD10 is used for comparison but it is understood that not all instruments will be operating to their full capacity. • none of the estimations are higher compared to values predicted in RD10
EPS/EDF General	• most instrument models need to be investigated	most instrument models need to be investigated
AL	• EDF accurate to within 20% margin.	• EDF accurate to within 20% margin.
CN	• EDF inaccurate to within 20% margin.	• EDF accurate power to within 20%.
CS	• EDF inaccurate to within 20% margin.	• EDF inaccurate to within 20% margin.
GD	• EDF inaccurate to within 20% margin. • This is explained by the effect of the environment on data vol production. i.e. the more dust the more data. • The data vol can be variable and adjusted with estimations given by PI team. (estimates to be refined.) GD/RSOC	• EDF accurate to within 20% margin.
LZ	• No EPS/EDF currently.	• No EPS/EDF currently.

Team	Data Volume	Power Consumption
MD	• Real data volume and power is not relevant for future checkouts because of the anomaly. (emergency switch off after 1hr of operation) • PI estimate is current best estimate.	-
MR	• EDF inaccurate to within 20% margin.	• EDF accurate to within 20% margin.
RP	• EDF accurate to within 20% margin. • Note section 3.3.2 can void this observation.	• EDF marginally inaccurate to within 20% margin. • Note section 3.3.2 can void this observation.
SE	• No EPS/EDF currently.	• No EPS/EDF currently.
SR	• No EPS/EDF currently.	• No EPS/EDF currently.
VR	• EDF accurate to within 20% margin.	• EDF accurate to within 20% margin.

6. Conclusions

The report shows the need for several modifications in preparation for PC1. This report will be referenced to ensure everything is covered for PC1.

Events and OOL that were reported during PC0 are under investigation and will be closed out as soon a possible. RD03 remains alive and tracks progress.

In terms of resource analysis, a deeper analysis is required to measure the impact of inaccuracies in prediction and modeling. Currently a 20% margin is considered adequate for planning purposes. This should be revised along with EDF modeling accuracies.

All other anomalies generated in this document are tacked in RD02