Eskom	WORKING PROCEDURE	Allocation Centre 38A	Reference Number KWW-TES-020	Rev 3
NNR: NO No.:	ENCAPSULATION OF RADIOACTIVE SLUDGE IN CONCRETE DRUMS			PAGE 1

KORC	ACCESS	IMPORTANCE CATEGORY	NEXT REVIEW DATE	DATE AUTHORISED
NO	Nuclear Restricted	SR	2023-06-07	2018-06-07

COMPILED / REVISED	REVIEWED	AUTHORISED
(sgd) U PHILANDER	(sgd) X NOVEMBER	(sgd) C Le ROUX
U PHILANDER	X NOVEMBER	C Le ROUX
SENIOR TECHNICIAN RADWASTE	SUPERVISOR RADWASTE	SENIOR SUPERVISOR RADWASTE
DATE 2018-04-24	**DATE** 2018-06-07	**DATE** 2018-06-07

THIS PROCEDURE HAS BEEN SEEN AND ACCEPTED BY:

U Philander	Document Custodian
E Ellis	ALARA

CATEGORY 2 – PROCEDURE AT THE JOB

FCA	ALARA REVIEW	SUPERSEDES
PROTECTION	YES 2018-03-22	KWW-TES-020, Rev 2 dd. 2015-03-12 FULL REVIEW

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1.0 PURPOSE

1.1 To describe the process for encapsulating radioactive liquid sludge in concrete drums.

2.0 SCOPE

2.1 Applicable to the operation of the TES system situated in the NAB.

3.0 DEFINITIONS AND ABBREVIATIONS

3.1 Definitions

N/A

3.2 Abbreviations

3.2.1 **NAB** – Nuclear Auxiliary Building

3.2.2 **RP** – Radiation Protection

3.2.3 **RPC** – Radiation Protection Certificate

3.2.4 **RPM** – Radiation Protection Monitor

4.0 REFERENCES

4.1 Referenced Documents

4.1.1 335-2, Rev 4: Koeberg Nuclear Power Station Management Manual

4.1.2 KAA-500, Rev 13: The Process for Controlled Documents

4.1.3 KSA-011, Rev 14: The Requirements for Controlled Documents

4.2 Applicable Documents

N/A

5.0 PREREQUISITES

	ACTIONS AND CHECKS	SIGN
5.1	The encapsulation of radioactive sludge must be carried out by the Radwaste Section under a Work Order and an RPC.	
5.2	RPM to be in attendance for the duration of the encapsulation.	
5.3	Ensure that the solid radwaste treatment system (TES) is available.	
5.4	Ensure that the demineraliser water distribution system (SED) is available.	
5.5	Ensure that the drain and vent system (RPE) is available.	
5.6	Ensure that the alarm processing system (KSA) is available.	
5.7	Ensure that the general control system (KRG) is available.	
5.8	Ensure that the instrument air distribution system (SAR) is available.	
5.9	Ensure TES CCTV cameras are functioning	
5.10	Drumming tunnel cameras 9 TES 001 TV, 003 TV must be switched on and off using respective pushbuttons on rack 9 TES 001 HG	
5.11	Mixer camera, 9 TES 002 TV, must be switched on and off on rack 9 TES 001 HG	
5.12	N030 cameras 9 TES 006 TV and 9 TES 007 TV must be switched on and off using respective pushbuttons on rack 9 TES 001 HG	
5.13	N265 crane camera, 9 TES 005 TV, must be switched on using pushbutton 5 on rack 9 TES 001 HG and off at local power box 90 MN 002 PR	
5.14	N030 crane camera, 9 TES 004 TV, must be switched on using pushbutton 4 on rack 9 TES 001 HG and off at local power box 90 MN 005 PR	

6.0 PRECAUTIONS AND LIMITATIONS

	ACTIONS AND CHECKS	SIGN
6.1	Ensure a clear pathway from station 1 to station 5 before concrete drum entering and exiting drumming tunnel to prevent equipment damage.	
6.2	Ensure movement of the chutes are not hindered. If movement of chutes are hindered, do not proceed and raise notification to clean mixer.	
6.3	Radwaste is responsible for cleaning of the mixer	
6.4	This procedure can be performed in any unit state	
6.5	Comply with Power Station Regulatory Safety Standards	

7.0 PRE-JOB PREPARATION

	ACTIONS AND CHECKS	SIGN
7.1	Generate and receive the Work Order from the Vertical Planner to drum radioactive sludge and discuss the work package.	
7.2	Inform the Chemistry Group that the drumming of radioactive sludge has been planned.	
7.3	The batching plant operators will select sufficient C1 concrete drums for the radioactive sludge campaign.	
7.4	TES operators to confirm the availability of the TES plant in the NAB.	
7.5	The batching plant operator confirms the availability of the 7-ton forklift and sufficient consumables for the concrete mixes.	
7.6	The batching plant operator takes a prepared C1 drum to the drum reception area of the NAB (N265). This is to allow the TES operators to carry out a dry run to check the TES functionality, operating all major components, excluding valves.	
7.7	After the dry run of the TES has been completed, transfer the C1 concrete drum to N030, placing the drum as near to the entry door as possible.	
7.8	Under the direct supervision of the RPM, transfer 360 litres of sludge from the radioactive sludge storage area into the C1 concrete drum in N030, filling to the pre-marked line on the inside of the steel liner.	
7.9	Inform Chemistry that they can now sample the liquid sludge for an isotopic analysis, pH and any other tests required.	
7.10	TES operators can then transfer the C1 drum to the TES drumming facility, station 1.	

8.0 INSTRUCTIONS

8.1 Encapsulating Radioactive Sludge into Concrete Drums

	ACTIONS AND CHECKS	IDENTIFICATION	COMMENTS	SIGN
8.1.1	Proceed to the filter floor and transfer the bogey of the overhead crane to operate on the rail through N505 and N510.	9 DMN 001 PR		
8.1.2	Open motorised hatch 9 DMN 010 CR to allow dry mix to be lifted to N505.	9 DMN 010 CR	Inform the NAB control room that DVN could be affected.	
8.1.3	Instruct the batching plant operators to prepare dry mix for sludge solidification in C1 drum.			
8.1.4	When the dry mix hopper is delivered to N264, send crane down to the 0 metre level.	9 DMN 001 PR		
8.1.5	Connect the crane hook to the dry mix hopper and raise the hopper to the filter floor level.	9 TES 003 DM	Use slow speed initially to restrict swinging of the hopper, and slow speed again when going through hatch 9 DMN 010 CR.	
8.1.6	Transport the dry mix hopper and place it on its support in N505. Connect an air hose to the hopper vibrator and open the air supply. Open the hopper discharge valve.	9 TES 003 DM TES 023 VS	Make sure that the limit switch is made on the support stand and light 057 LA is lit at TES control panel station 4.	
8.1.7	Carry out a final inspection of the C1 concrete container at the entrance to the TES drumming facility.		Container in sound condition with no cracks or chips, liner properly located.	
8.1.8	Lift the C1 container using the overhead crane and transfer it onto trolley 002 CX.	9 DMN 002 PR	C1 drum properly located on 002 CX trolley.	
8.1.9	At control station 2, select C1 drum.	9 TES 001 TO	“Drum C1” light 160 LA is lit.	
8.1.10	Open door A, using pushbutton	9 TES 009 TO	Signal light 010 LA is lit when door is open.	
8.1.11	Start the transfer of 002 CX trolley with C1 drum from station 1 to station 2, using pushbutton	9 TES 011 TO	Signal light 009 LA is lit when 002 CX trolley is at station 2.	
8.1.12	Close door A using pushbutton	9 TES 010 TO	Signal light 011 LA is lit when door A is closed.	
8.1.13	Raise crab 001 CX to the high position, using pushbutton	9 TES 013 TO	Signal light 013 LA is lit when 001 CX crab is in high position.	

ACTIONS AND CHECKS		IDENTIFICATION	COMMENTS	SIGN
8.1.14	Lower crab 001 CX to the transfer position, using pushbutton	9 TES 014 TO	Signal light 014 LA is lit when 001 CX crab is in the transfer position.	
	NOTE: *The operator must now go to station 3 control panel for the following operations.*			
8.1.15	Open door B, using pushbutton	9 TES 028 TO	Signal light 018 LA is lit when door B is open.	
8.1.16	Start the transfer of crab 001 CX from station 2 to station 3, using pushbutton.	9 TES 017 TO	Signal light 024 LA is lit when 001 CX crab is at station 3.	
8.1.17	Close door B, using pushbutton	9 TES 029 TO	Signal light 019 LA is lit when door B is closed.	
	NOTE: *The operator must now go to station 4 control panel for the following operations.*			
8.1.18	Select “Drum” using keyswitch	9 TES 004 CC	At station 4 control panel.	
8.1.19	Start the transfer of crab 001 CX from station 3 to station 4, using pushbutton.	9 TES 019 TO	Signal light 025 LA is lit when 001 CX crab is at station 4.	
8.1.20	Retract station 4 dip tray, using switch	9 TES 022 CC	Signal light 073 LA is lit when the drip tray is in the fully retracted position.	
8.1.21	Put exhaust fan of 9 TES 001 EG mixer selector switch in auto position.	9 TES 046 CC		
8.1.22	Raise the crab 001 CX to the high position using switch	9 TES 021 CC	Signal light 038 LA is lit when the drum is in the high position. Exhaust fan of 9 TES 001 EG will come on automatically and signal light 154 LA is lit.	
8.1.23	Switch on the camera and adjust the picture for a clear view of the inside of the C1 concrete container.	Remote Camera inside 9 TES 001 EC	Drumming of sludge must not proceed if the camera is not functioning.	
8.1.24	Start lowering the mixer blade to the mix position using switch	9 TES 025 CC	Signal light 157 LA is lit. Observe the blade lowering sequence with the camera. Stop is automatic in the mix position.	
8.1.25	Start slow speed rotation of the mixer blade, using pushbutton	9 TES 039 TO	Signal light 156 LA is lit.	
8.1.26	Position the dry products chute using switch	9 TES 044 CC	Signal light 150 LA is lit when the dry products chute is in the correct position for discharge into the C1 drum.	
8.1.27	Start the dry products screw conveyor using switch	9 TES 024 VS 9 TES 026 CC	Signal light 076 LA is lit when the screw conveyer starts.	

	ACTIONS AND CHECKS	IDENTIFICATION	COMMENTS	SIGN
	NOTE: *The operator must monitor the flow of dry products on the monitor. The discharge time for the entire dry products to enter the C1 drum is (35 – 45 minutes). After this time and when no more dry product is observed flowing on the monitor, proceed as follows.*			
8.1.28	Stop the dry products screw conveyor using switch	9 TES 024 VS 9 TES 026 CC	Signal light 076 LA is extinguished.	
8.1.29	Retract the dry products chute using switch	9 TES 044 CC	Signal light 150 LA is extinguished when the dry products chute is fully retracted.	
8.1.30	Carry on mixing the contents of the C1 drum for another (4 – 6 minutes).		Any dry product lying on top of the mix will be drawn into the wet mix.	
	NOTE: *Experience has shown that dry layers may be evident in the mix. Therefore, it is advisable to raise and lower the blade of the mixer at least twice to make sure that the mix is completely homogeneous, with no dry spots.*			
8.1.31	Start raising the mixer blade to the high position using pushbutton	9 TES 153 TO	Signal light 157 LA is lit. Mixer is rising to the high position. Rising and rotation of the blade will stop automatically when the blade reaches the high position.	
8.1.32	Start to lower the mixer blade to the mix position using switch	9 TES 025 CC	Signal light 157 LA is lit. The mixer blade is lowering to the mix position.	
8.1.33	Observe the lowering of the mixer blade, using the camera, before the mixer blade enters the mix. Start the mixer blade rotation using pushbutton	9 TES 039 TO	Signal light 136 LA is lit. The mixer blade must be rotating before entry into the mix to prevent undue torque on the mixer motor.	
8.1.34	Check the entry of the mixer blade into the wet mix, using the camera.			
8.1.35	Continue mixing for (4 – 6 minutes) then repeat steps 8.1.31 to 8.1.33 one more time.			
	NOTE: *Close observations of all these actions and checks using the camera will tell the operator when the mix is indeed homogeneous. No more dry patches will be brought to the surface of the mix by raising the mixer blade. The instruction sequence can now be carried out as follows.*			
8.1.36	Start raising the mixer blade to the high position using pushbutton	9 TES 153 TO	Signal light 157 is lit. The mixer is rising to the high position. Rising and rotation of the mixer blade will stop automatically when the blade reaches the high position.	

ACTIONS AND CHECKS		IDENTIFICATION	COMMENTS	SIGN
8.1.37	Lower the crab 001 CX to the transfer position using switch	9 TES 021 CC	Signal light 039 LA is lit. Crab 001 CX is in the transfer position. The mixer exhaust fan will stop automatically once the crab is in the transfer position. Signal light 9 TES 154 LA is extinguished.	
8.1.38	Close the drip tray using switch	9 TES 022 CC	Signal light 078 LA is lit when the drip tray is in the fully closed position.	
8.1.39	Start the transfer of crab 001 CX from station 4 to station 3 using pushbutton	9 TES 036 TO	Signal light 040 LA is extinguished. Station 4 control panel	
8.1.40	Check that crab 001 CX is at station 3.		Signal light 024 LA is lit Station 3 control panel	
8.1.41	Open door B using pushbutton	9 TES 028 TO	Signal light 018 LA is lit.	
8.1.42	Once door B is fully open, start transfer of crab 001 CX from station 3 to station 2 using pushbutton	9 TES 018 TO	Signal light 024 LA is extinguished at station 3 when crab 001 CX is at station 2. Signal light 023 LA is lit at station 3 and signal light 012 LA is lit at station 2 control panel.	
8.1.43	Close door B using pushbutton	9 TES 029 TO	Signal light 019 LA is lit Station 3 control panel	
	NOTE: *The operator must now go to station 2 control panel for the following operations.*			
8.1.44	Start crab 001 CX to go to the low position using pushbutton	9 TES 015 TO	Signal light 015 LA is lit.	
8.1.45	When crab 001 CX is at the low position and the C1 drum is resting on trolley 002 CX, open door A using pushbutton	9 TES 009 TO	Signal light 010 LA is lit when door A is open	
8.1.46	Start the transfer of trolley 002 CX with the C1 drum to station 1 using pushbutton	9 TES 012 TO	Signal light 009 LA is lit when trolley 002 CX is at station 1.	
8.1.47	Close door A using pushbutton	9 TES 010 TO	Signal light is lit when door A is closed.	
	NOTE: *The operator must now go to station 1 control panel for the following operations.*			
8.1.48	Using the overhead crane, lift the C1 concrete drum clear of trolley 002 CX and move into the area for RPM to survey the base, side and top of the finished drum.	9 DMN 002 PR		
8.1.49	RPM fill in the results of the survey on the Waste Transfer Form (LLW-13).			

ACTIONS AND CHECKS	IDENTIFICATION	COMMENTS	SIGN
********** ***CAUTION:*** *Before opening hydraulic doors to N030, the operator must check that the 9 DMN 005 PR crane is in the HOME position. Hydraulic doors to N030 can now be opened and the drum transferred to N030 using the 9 DMN 002 PR crane. Once the drum is down in N030 and cranage is returned to the 0 metre level, the hydraulic doors can be shut. The operator can now go to the –6,7 metre level to move the drum to the temporary storage area for curing before final capping.* **********			
8.1.50 The TES operator can now transfer the finished drum to the N030 temporary storage area for drying and final capping.			
NOTE 1: *Finished, uncapped drums must not be stored directly under the hydraulic doors to N030 because of possible shine and resulting risk of exposure to personnel working around the doors.* ***NOTE 2:*** *Radiation Protection performs a radiation survey around the hatch area to verify the extent of any shine from N030.*			

9.0 ACCEPTANCE CRITERIA

N/A

10.0 RECORDS

10.1 All records generated must be retained as permanent records.

11.0 ATTACHMENTS

Appendix 1 – Justification

APPENDIX 1

JUSTIFICATION

Revision 2

1 Scheduled review.

2 Procedure aligned to address human performance fundamentals in ensuring proper place keeping in accordance with KGA-088.

Safety Screening S2015/0071

Revision 3

1 Full review of procedure to include requirements and instructions for the use of the cameras installed as part of modification 06035, Replacement of TES cameras, to address RC 16130.

2 Added para 5.9 to 5.14 to address the requirements and instructions for the use of cameras to address mod 06035.

Safety Screening S 2018/0205