Nuclear-1 Consistent Data Set

	Unit	Envelope
Auxiliary Steam Boiler		
Auxiliary Steam Boiler (x3)	t/h	32
Diesel Storage Tanks (x2)	m^3	230
Chlorination		
Circulating Water Treatment System (CTE) at Koeberg (per unit)		
This system produce sodium hypochlorite by pumping seawater through an electrolyser. The concentration of active chlorine after the electrolysers in the solution is approximately 1.5 mg/kg. The solution is stored in a holding tank and is pumped to the inlets of the circulating water system (CRF) and the essential service water (SEC). Flow rate through electrolysers is 57,5 ton/h.		
Total circulating water treatment flow (to be mixed with cooling water	ton/h	58
Total main cooling water flow	kilo ton/h	144
Chlorine dose to sea at Koeberg		
Normal Operation-Continuous	ug/kg	300
Shock (3x/day for 15 min)	ug/kg	599
Continuous consumption rate	kg/h	86.25
Shock consumption rate	kg/h	172.5
Total dose / day	kg/day	2 199
Old Values (from Koeberg plant)		
Circulating Water System (CRF)		
Normal Operation-Continuous	mg/kg	2.00
Shock (3x/day for 15 min)	mg/kg	4.00
Continuous consumption rate	kg	13 565
Shock consumption rate	kg	848
Total consumption rate	kg	14 413
Essential Water System (SEC)		
Normal Operation-Continuous	mg/kg	2.00
Shock (3x/day for 15 min)	mg/kg	4.00
Continuous consumption rate	kg	656
Shock consumption rate	kg	41
Total consumption rate	kg	697
Civil Works		
(Existing landscape)		
Maximum height above MSL	m	14
Minimum height above MSL	m	6

Finished Terrace above MSL	m	10
Spoil (for Nuclear-1 power station)		
Bantamsklip		
Natural Ground to Topsoil (0,3m deep)	m³	197,850
Topsoil to Terrace at +10mamsl	m³	8,004,896
Terrace at +10mamsl to Average Bedrock at -3mamsl	m³	3,762,828
SAND STOCKPILE	**m³**	**11,965,574**
Terrace for HV Yard at +38mamsl	m³	195,593
Average Bedrock at -3mamsl to Terrace at +10mamsl	m³	1,696,708
BACKFILL	**m³**	**1,892,301**
SAND STOCKPILE	m³	11,965,574
BACK FILL	m³	1,892,301
SAND TO SPOIL	**m³**	**10,073,273**
Average Bedrock at -3mamsl to Intake Basin at -16mamsl	m³	1,161,306
Intake Tunnel System (1000m long at ± -35m deep)	m³	37,285
ROCK STOCKPILE	**m³**	**1,198,591**
TOTALS FOR BANTAMSKLIP		
Duynefontein		
Natural Ground to Topsoil (0,3m deep)	m³	183,920
Topsoil to Terrace at +10mamsl	m³	4,284,328
Terrace at +10mamsl to Average Bedrock at -4mamsl	m³	4,344,860
SAND STOCKPILE	**m³**	**8,813,108**
Terrace for HV Yard at +38mamsl	m³	153,285
Average Bedrock at -4mamsl to Terrace at +10mamsl	m³	2,180,059
BACKFILL	**m³**	**2,333,344**
SAND STOCKPILE	m³	8,813,108
BACK FILL	m³	2,333,344
SAND TO SPOIL	**m³**	**6,479,764**
Average Bedrock at -4mamsl to Intake Basin at -16mamsl	m³	1,245,065
Intake Tunnel System (1000m long at ± -35m deep)	m³	37,285
ROCK STOCKPILE	**m³**	**1,282,350**
TOTALS FOR DUYNEFONTEIN		
Thyspunt		
Natural Ground to Topsoil (0,3m deep)	m³	229,456
Topsoil to Terrace at +10mamsl	m³	5,524,285
Terrace at +10mamsl to Average Bedrock at -3mamsl	m³	2,136,561
Average Bedrock at -3mamsl to Intake Basin at -16mamsl	m³	117
SAND STOCKPILE	**m³**	**7,890,419**
Terrace for HV Yard at +111mamsl	m³	157,616
Average Bedrock at -3mamsl to Terrace at +10mamsl	m³	1,360,759
BACKFILL	**m³**	**1,518,375**
SAND STOCKPILE	m³	7,890,419
BACK FILL	m³	1,518,375
SAND TO SPOIL	**m³**	**6,372,044**
Terrace at +10mamsl to Average Bedrock at -3mamsl	m³	289,276

Average Bedrock at -3mamsl to Intake Basin at -16mamsl	m^3	381,795
Intake Tunnel System (1000m long at ± -35m deep)	m^3	37,285
ROCK STOCKPILE	**m^3**	**708,356**
TOTALS FOR THYSPUNT		
Old values		
Thyspunt (for entire power station)		
East of Thyspunt	m^3	20 653 094
West of Thyspunt	m^3	33 212 000
Bedrock	m^3	6 000 000
Demineralisation Plant		
Units	ea	2
Capacity per unit	m^3/day	2 000
Conductivity of water	S/cm	0.2×10^{-6}
Silica SiO_2	g/l	20×10^{-6}
Sodium	g/l	1×10^{-5}
Suspended solids	g/l	50×10^{-6}
Desalination Plant		
Type		Reverse Osmoses
Will the sea water needed be taken up through the uptake pipes used for cooling water?		Not initially. Will later be incorporated when the intake basin is complete
What maximum input volume of water will be needed and how does it compare to the uptake of cooling water	m^3/day	22 500 maximum = 0.34 % of intake
Output of plant (Site preparation)	m^3/day	300
Output of plant (earth works)	m^3/day	3x 3000
Output of plant (Construction)	m^3/day	1 300
Output of plant (Commissioning)	m^3/day	2 100
Output of plant (operation)	m^3/day	6 000
Will the desalination plant run continuously?		It will run constantly during earth works. Only one unit will run during construction and the operation of the 3 units will alter during operation
What is the volume and chemical composition, salinity, PH and temp of discharged water?		The effluents of reverse washings in the water will be directed to the collection sump the mixture of water and chemicals shall then be directed by means of pumping to a neutralisation pit. Discharge at ambient
Brine		
Input	ppm	35 000
Output	ppm	59 000
Diesel Generators		
(Per nuclear unit)		
Emergency Diesel Generators		
Number of generators	each	4
Output Capacity	MW	8
Diesel storage arrangement		Run at rated power for 72 hours

Testing hours per week	h	2.00
Station black-out Diesels		
Number of generators	each	2
Output Capacity	MW	2.8
Diesel storage arrangement		Run at rated power for 24 hours
Testing hours per week	h	2.00
Diesel storage tanks	kl	1 000
Dose Rates		
Dose Rates due to Direct Radiation Sources		
Normal Operation		
(For Power Station)		
100m	nSv/h	0.30
300m	pSv/h	27.00
1000m	pSv/h	0.20
Incident Conditions		
100m	nSv/h	2.50
300m	nSv/h	0.20
1000m	pSv/h	1.60
Maximum Effective Dose due to Liquid and Gas Release		
(For Power Station)		
Normal Operation	mSv/a	less than 0.1
Incident and Accident	mSv/a	less than 10
Electrical and Thermal Characteristics		
(per unit)		
Gross Electrical Output	MWe	1784
Net Electrical Output	MWe	1650
House Load	MWe	134
Thermal Output	MWth	4616
Efficiency	%	35.75%
Availability	%	91.5%
18 months	%	91.5%
First 2 years	%	
Power Factor at Gen Terminals		0.90
Employees on Site		
Please note that this will be the maximum number of employees per group. The peak will not be at the same time for all groups		
Eskom Project Staff		140
Consultants		40
Vendor Staff		2 172
Vendor Construction Workers		5 000
Eskom Operation Staff		1 385
Employees off Site		

Substation		300
Transmission Lines		400
Helicopter Landing Pad		
Landing pad planned on site	Yes / No	Yes
Aviation fuel storage tank	m³	5
Housing		
Staff Village		
General Facilities		
Land Requirement	ha	44.2
Recreation Club	m²	2 600
Indoor Sport & Function Hall	m²	1 600
Shop	m²	2 500
Medical Clinic	m²	600
Entrance Security Building	m²	200
Workshop & Stores	m²	400
Kitchen & Dining Room	m²	1 400
School for Expats	m²	3 600
Primary School	m²	2 000
Secondary School	m²	2 200
Tennis Courts 4 off	m²	800
Squash Courts 3 off	m²	150
Rugby 2 off	m²	14 000
Soccer 1 off	m²	14 000
Swimming Pool 1 off	m²	400
Basketball 4 off	m²	400
Parking 270 cars	m²	5 608
Vendor Staff		
Land Requirement	ha	89.5
Total Vendor Construction Staff	ea	2 172
4 Bedroom Houses		
Qty	ea	540
Size	m²	180
Stand Size	m²	500
3 Bedroom Houses		
Qty	ea	345
Size	m²	142
Stand Size	m²	450
2 Bedroom Houses		
Qty	ea	307
Size	m²	123
Stand Size	m²	400
Single Accommodation Units		
Qty	ea	980
Size	m²	66

Stand Size	m²	100
Eskom Project Personnel		
Land Requirement	ha	12
Total Eskom Project Staff	ea	140
Consultants	ea	40
4 Bedroom Houses		
Qty	ea	18
Size	m²	180
Stand Size	m²	500
3 Bedroom Houses		
Qty	ea	50
Size	m²	142
Stand Size	m²	450
2 Bedroom Houses		
Qty	ea	45
Size	m²	123
Stand Size	m²	400
Single Accommodation Units		
Qty	ea	67
Size	m²	66
Stand Size	m²	100
Consultants		
Qty	ea	40
Size	m²	66
Stand Size	m²	100
Eskom Staff		
Land Requirement		65.7
Senior Managers (E band)		
Qty	ea	1
Size	m²	220
Stand Size	m²	1 000
Managers (M Upper)		
Qty	ea	9
Size	m²	190
Stand Size	m²	800
MMM		
Qty	ea	280
Size	m²	175
Stand Size	m²	600
Artisans		
Qty	ea	310
Size	m²	75
Stand Size	m²	300
Artisans		
Qty	ea	400

Size	m²	50
Stand Size	m²	300
Construction Village		
Land Requirement	ha	50.9
Housing		
Workers on Site	ea	5 000
% local	%	25
Workers Require Housing	ea	3 750
12 bed Units Required		
Qty	ea	250
Size	m²	122
8 Bed Units Required		
Qty	ea	94
Size	m²	92
Support Facilities		
Laundry	m²	66
Parking (25% of Residents)	m²	25 313
Canteen	m²	3 686
Lapa with TV	m²	80
Liquor Outlet	m²	184
Bus Terminus	m²	25 313
Admin Office	m²	80
Clinic	m²	600
Sewer	m²	2 000
Recreation Facilities		
Tennis (40x20) 4 off	m²	800
Soccer (110x75) 2 off	m²	14 000
Rugby (144x70) 1 off	m²	9 000
Swimming Pool (15x15) 1 off	m²	400
Basketball (20x20) 4 off	m²	400
Parking (28x40)	m²	17 692
Hydrogen Plant (H2)		
H_2 Plant / Unit	Nm^3/h @ 25	15
4 x Storage Tanks	Nm^3	30
Intake / Outfall Structure		
Intake		
Distance off shore	m	1000 to 2000
Number of Tunnels (for power station)	ea	1 or 2
Diameter of tunnels	m	5 to 10
Structure at Intake		1. Letterbox. 2. The design can also include a vertical tube extending approximately 3-5m above the sea bed to prevent the drawing of large quantities of sediment.
Water velocity at intake	m/s	approx 1,0

Water velocity in tunnel	m/s	approx 3,0
Depth of Tunnels	m	Approximately 30
Spoil		Placed in Rock Retaining Wall and unsuitable material to be used to level HV yard. Any additional will be transported to a suitable approved location off site
Outfall		
Outfall type		Can be off shore via tunnels or out flow like Koeberg.
Tunnel alternative		
Number of tunnels	ea	3 to 4
Diameter of tunnels	m	approximately 3
Distance off shore	m	approximately 500
Depth of Tunnels	m	approximately 5
Water velocity at the outfall	m/s	approx 1,0
Gas Turbines		
General Specifications		
Gross Output Power (2off)	MW	25.30
Gross Efficiency	%	34.00
Fuel mass flow	kg/s	1.74
Exhaust Gas		
Exhaust gas mass flow	kg/s	85
Exhaust gas temperature	℃	538
Gas Composition		
N_2	%Vol	74.80
O_2	%Vol	13.90
CO_2	%Vol	4.20
H_2O	%Vol	6.20
Ar	%Vol	0.90
SO_2	%Vol	0.00
Noise		
Average sound attenuation @ 1m from the package and 1,5m above ground	dB(A)	85
After additional sound damping	dB(A)	80
Noise		
Noise level of Abnormal vehicles		
Rotran vehicles	Engine	CAT C27 ACERT V12 950hp / 709kW range
Distance measured 15m according to test procedures specified in SAE J88 Jun86, mid gear moving operation	dB(A)	82
Gas Turbine Noise Level		
Average sound attenuation @ 1m from the package and 1,5m above ground	dB(A)	85
After additional sound damping	dB(A)	80

NNR Requirements		
Zones		
Exclusion zone	km	Note: These figures will be determined by the NNR after a full examination of the safety case
Evacuation zone	km	Note: These figures will be determined by the NNR after a full examination of the safety case
Time to evacuate site	h	Note: These figures will be determined by the NNR after a full examination of the safety case
Non-radioactive releases		
Operational Phase		
Emissions will be calculated for:		
Emergency generators (if any);		
Vehicle emissions; and		
Any other source of significant air emissions.		
Dispersion modelling require		
Emission information of emergency generators and other process emission sources (if any) include:		
Stack		
Gas		Ventilation
Location of release point;	ft	Next to reactor
Height of release above ground;	m	96.00
Vent tip diameter;	m	3.00
Gas exit volume	m^3/min	
Exit gas velocity (normal)	m/s	5.80
Exit gas velocity (outage)	m/s	6.35
Exit gas temperature (winter)	℃	Ambient
Exit gas temperature (summer)	℃	Ambient
Gas Turbine Exhaust Gas		
Exhaust gas mass flow	kg/s	85
Exhaust gas temperature	℃	538
Gas Composition		
N_2	%Vol	74.80
O_2	%Vol	13.90
CO_2	%Vol	4.20
H_2O	%Vol	6.20
Ar	%Vol	0.90
SO_2	%Vol	0.00
Whilst it is not believed to be a significant source, vehicle impacts will be included and will require the road layout design, number of vehicles and time schedules		
Nuclear Fuel		
Enrichment of fuel (by weight)	%	4.95
Rods / Assembly	each	265

Assemblies / load	each	241
Fuel active height	m	4.20
Fuel assembly pitch	m	0.215
Mass of fuel rod	kg	2.80
Mass of assembly	kg	780
Total assembly mass in reactor	ton	187.98
Duration of fuel cycle	months	18
Spent fuel per unit over lifecycle (Approx)	ton	1 880
(Approx)	m^3	468
Nuclear Waste		
Low level waste / year	Steel drums	470
Mass of steel drums (approx)	kg	50-100
Intermediate level waste / year	Concrete	160
Mass of concrete drums (approx)	ton	6.3
Number of trucks to transport the low and intermediate level waste / year	each	The existing Eskom lorry / trailer at Koeberg can take 80 steel drums at a time plus 3 concrete drums. We transport at our own and Necsa's convenience to ensure it is optimised for both parties. As there is a lot of storage space, when and how often we transport is not an issue. We stay away from school holidays and rainy season as part of the road is not tarred.
Quantity Surveying		
(per unit)		
Nuclear Island		
Concrete	CY	
	m^3	289 000
Concrete pouring per day	m^3	1 000
Concrete Reinforcing	TN	
	t	39 500
Structural Steel	TN	16 770
	t	15 213
LB Pipe	foot	230 082
	m	70 129
Cable	foot	3 645 018
	m	1 111 001
Terminations	ea	158 252
Balance of Plant Estimates		
Concrete	CY	142 122
	m^3	108 660
Concrete Reinforcing	TN	7 458
	t	6 766

Structural Steel	TN	1 432
	t	1 299
Small Bore Pipe	foot	42 114
	m	12 836
LB Pipe	foot	537 777
	m	163 914
Conduit	foot	1 250 841
	m	381 256
Cable	foot	2 975 342
	m	906 884
Terminations	ea	22 025
Reactor pressure vessel		
Design pressure	bar	167
Design temperature	℃	351
Reactor power	MWth	4616
Coolant Pressure	Map	15.50
Hot leg temperature	℃	330.00
Cold leg temperature	℃	295.20
Road Servitudes - On Site		
Servitude	m	Provincial road standards
Seismic		
Peak Ground Acceleration (PGA)		
Horizontal		0.25
Vertical		0.19
Sewer		
People during construction	ea	8 000
Water consumption / person / day	l	120
Sewer plant to treat 70% (rounded)	m³/day	750
Waste Water Treatment Plant		
From buildings		SEO/SHE & HX
Potentially active waste (SEK/KER): 6 tanks	m³	750
Potentially active waste TER: 2 tanks	m³	750
Water Consumption		
Construction		
(For Power Station)		
Construction Village	m³/year	365 000
	m³/month	30 000
	m³/day	1 000
	m³/s	0.012
Site establishment (preparation)	m³/year	109 500
	m³/month	9 000
	m³/day	300
	m³/s	0.003

Excavations	m^3/year	3 285 000
	m^3/month	270 000
	m^3/day	9 000
	m^3/s	0.104
Construction on site	m^3/year	474 500
	m^3/month	39 000
	m^3/day	1 300
	m^3/s	0.015
Commissioning	m^3/year	766 500
	m^3/month	63 000
	m^3/day	2 100
	m^3/s	0.024
Operation		
(For Power Station)		
Total Cooling Water Flow	m^3/year	2 396 736 000
(Reactor Coolant Flow rate	m^3/month	196 992 000
	m^3/day	6 566 400
	m^3/s	76.0
Sea Water Temperature Increase	℃	12
Fresh Water	m^3/year	2 190 000
	m^3/month	180 000
	m^3/day	6 000
	m^3/s	0.069
Demineralised Storage Tanks	m^3	4x2 200m^3+ 2x800m^3
Potable Water Storage Tanks	m^3	2x9 000m^3
Fire Water Storage Tanks	m^3	2x1 800m^3
Wind		
Plant design parameters to wind		
Diesel Buildings	m^3/s	50
BOP	m^3/s	43
Conventional Island	m^3/s	50

Other Data

Expected Load Demand

Area Description	2007	2008	2010	2012	2014	2017	2020	2025	2027
Southern Grid (Western Cape) (MW) (12% average)	1508	1668	2536	3411	3718	4238	4455	5154	5245
Western Grid (Eastern Cape) (MW) (3% average)	3991	4222	4467	4727	5002	5295	5605	5934	6283

Transmission Losses

(Difference between Bravo at Kendal and a Nuclear Plant of approximately 3300MW at the following sites

Input Station	MW	3300	%
Bantamsklip	MW	293	8.9
Duynefontein	MW	275	8.3
Thyspunt	MW	351	10.6

Transport of Fuel

Transport Cost of reload

Koeberg		
Europe to Cape Town	Rand	3 600 000
Cape Town to Duynefontein	Rand	400 000