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THE AUSTRALIAN ADMINISTRATIVE STAFF COLLEGE ASSOCIATION

SYMPOSIUM ON MINING
AND THE PETRO CHEMICAL INDUSTRY

THE OPPORTUNITIES FOR URANIUM DEVELOPMENT
IN
SOUTH AUSTRALIA

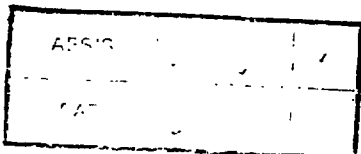
20 JULY 1979

ADELAIDE

NORTON JACKSON

MANAGING DIRECTOR

AMDEL



THE OPPORTUNITIES FOR URANIUM DEVELOPMENT IN SOUTH AUSTRALIA

MR CHAIRMAN, GENTLEMEN:

I WELCOME THE INVITATION TO JOIN THIS DISTINGUISHED GATHERING, TO ADDRESS YOU ON THE SUBJECT OF THE OPPORTUNITIES FOR URANIUM DEVELOPMENT IN THIS STATE.

I PLAN TO TELL YOU HOW THREE KNOWN URANIUM DEPOSITS ARE LIKELY TO BE DEVELOPED. BEFORE THIS, I WILL SHOW THE WORLD ENERGY AND URANIUM REQUIREMENTS WHICH INDICATE THE NEED FOR THE MINING. I WILL FINISH WITH SOME BRIEF OBSERVATIONS ON URANIUM ENRICHMENT.

THE MAIN POINT ABOUT THE STATISTICS ON POWER AND URANIUM ESTIMATES IS NOT THEIR ACCURACY BY COUNTRY, WHICH I COULD NOT DEFEND IN DETAIL ANY MORE THAN FARMERS OR MANUFACTURERS CAN PREDICT ACCURATELY WOOL CONSUMPTION OR CAR SALES BY COUNTRY FOR 20 YEARS AHEAD. HOWEVER, THE ORDERS OF MAGNITUDE ARE CLEAR, AND SOMEWHAT OVERWHELMING. THE STARTING POINT IS THE WORLD POPULATION, WHICH WAS A FEW MILLION IN THE YEAR OF CHRIST AND WAS A MERE BILLION (US STYLE) AT THE TURN OF THE FIRST CENTURY. IT WAS 2 BILLION IN 1936, 4 BILLION IN 1975, AND WILL BE 8 BILLION IN 20 YEARS - AT THE TURN OF THE NEXT CENTURY.

IN TERMS OF ENERGY REQUIREMENTS TO MEET THIS GROWTH, THERE ARE NO BETTER ESTIMATES THAN GIVEN BY THE WORLD ENERGY CONFERENCE LAST DECEMBER.

SLIDE 1

THIS SHOWS THE MAJOR EXPANSION WITH COAL AND NUCLEAR ENERGY, WITH THE LATTER SHOWING DRAMATIC GROWTH RATES FROM THE SMALL BASE.

TO GIVE SOME IDEA WHAT THIS MEANS IN TERMS OF MINING: AT THE INTERNATIONAL MINERAL CONFERENCE IN WARSAW LAST MONTH, A RUSSIAN SPEAKER POINTED OUT WE WILL NEED TO MINE AS MUCH ROCK IN THE NEXT 20 YEARS AS WE HAD MINED IN PREVIOUS HISTORY TO ACCOMMODATE OUR INDUSTRIAL NEEDS.

TO BE MORE SPECIFIC, COAL WILL BE QUADRUPLED IN NEEDS BY THE YEAR 2020. AUSTRALIA'S SHARE IS ESTIMATED AT 400 MILLION TONS PER YEAR. THIS WILL REQUIRE THAT WE BRING IN ANOTHER 90 MILLION TONS, OUR PRESENT RATE, EVERY 10 YEARS.

THE URANIUM REQUIREMENT IS NOT SO EASY TO FORECAST, AS IT DEPENDS FIRST ON THE PROPORTION OF POWER NEEDS WHICH IS FROM NUCLEAR ENERGY. IT CAN BE ASSUMED THAT A LARGE PROPORTION OF ELECTRICAL NEEDS WILL BE NUCLEAR; PROBABLY AS HIGH AS 60 PER CENT BY 2020. THEN URANIUM REQUIREMENTS DEPEND ON THE SPEED WITH WHICH URANIUM CONSERVING BREEDER-REACTORS ARE INTRODUCED. WE ASSUME THIS WILL BE IN THE 1990'S FOR THE TECHNICALLY ADVANCED COUNTRIES.

IN THE IMMEDIATE FUTURE, DEMAND IS DIFFICULT TO ASSESS BECAUSE OF THE FOLLOWING FACTORS:

SLIDE 2

- (A) STOCKPILING POLICIES
- (B) REQUIREMENTS FOR ENRICHMENT
- (C) COST OF PRODUCTION RELATIVE TO OIL AND COAL
- (D) LEVELS OF SUSTAINED ECONOMIC GROWTH
- (D) AVAILABILITY OF TECHNICAL PERSONNEL
- (F) OPPOSITION TO NUCLEAR POWER
- (G) NON-PROLIFERATION POLICIES.

AN APRIL 1979 REPORT BY THE PRESIDENT OF URANIUM CANADA, ASSUMING THE LOWEST OF URANIUM FORECASTS, SHOWS CUMULATIVE NEEDS OF 3 MILLION TONS BY THE YEAR 2000, AND 9.5 MILLION TONS BY 2 0 2 0.

SLIDE 3

THE URANIUM INSTITUTE FIGURES OF FEBRUARY THIS YEAR INDICATE PRODUCTION OF 44 000 TONS/YEAR BY 1980, 78 000 TONS/YEAR BY 1990 - CUMULATIVELY 760 000 TONS. AT THIS RATE WE WOULD HAVE 1.6 MILLION BY 2000, OR HALF OUR REQUIREMENTS. NOTE RUSSIAN AND CHINESE PRODUCTION IS NOT INCLUDED, AND THAT WILL GO SOME WAY TO MEETING THE DIFFERENCE. HOWEVER, IN SPITE OF THE INDICATED TARGET OF CLOSE TO 13 000 TONS/YEAR IN AUSTRALIA, IT WOULD APPEAR THERE IS ROOM FOR US TO TAKE A HIGHER SHARE OF THE MARKET.

SLIDE 4

THE CANADIAN REPORT SHOWS THE ADDITIONAL MINES REQUIRED TO PRODUCE THE URANIUM REQUIRED BY 2015. THE ORDER OF MAGNITUDE IS RELATIVE TO MINES WE ALREADY KNOW, THOUGH THE GUESSING AT INDIVIDUAL MINES SOMEWHAT INEXACT.

NOW TO THE THREE KNOWN DEPOSITS IN SOUTH AUSTRALIA.

FIRST ARE THE BEVERLEY OREBODIES, WHERE THE SEDIMENTARY DEPOSITS HAVE FORMED FROM THE DRAINAGE OF THE FLINDERS RANGE, EAST TOWARDS LAKE FROME. A FEASIBILITY STUDY WAS FIRST COMPLETED IN 1972 FOR THE WESTERN URANIUM LTD AND THE ETP GROUP - NOW OTP AND WESTERN NUCLEAR AUSTRALIA LTD. THE ROCK IS POORLY CONSOLIDATED SANDSTONES AND CLAYS, WITH AN OREBODY OF 5 TO 6 MILLION TONS CONTAINING 12 000 TONS OF URANIUM OXIDE. IN PERSPECTIVE, THIS IS TEN TIMES THE SIZE OF RADIUM HILL AND OF COMPARABLE GRADE. IT WILL BE

MINED BY OPEN PIT, WHICH WILL HAVE TO BE QUITE LARGE BECAUSE THE PIT WILL HAVE A SHALLOW SLOPE OF SOME 30°, AND THE OREBODIES ARE AT 130 M. THE WATER TABLE IS AT 50 M, SO DRAINAGE CONTROL WILL BE NECESSARY.

THE ORE IS AMENABLE TO CONVENTIONAL SULPHURIC ACID LEACH, WITH COUNTERCURRENT DECANTATION, AND SOLVENT EXTRACTION TO PRODUCE YELLOW CAKE FOR SHIPMENT. RECOVERY OVER 90 PER CENT IS INDICATED.

SLIDE 5

THE FIGURES I QUOTE HEREIN CAN ONLY BE TAKEN AS ORDER OF MAGNITUDE. URANIUM WAS TRIPLED IN PRICE, AS HAVE WAGES, AND THE CONSUMER PRICE INDEX HAS MORE THAN DOUBLED SINCE ESTIMATES WERE MADE IN 1972. THE COST OF BULLDOZERS, CONVEYORS, STRIPPING EQUIPMENT, IS ESTIMATED AT \$25 MILLION TO REMOVE 150 000 TONNES OF OVERBURDEN/DAY AND 2000 TONS OF ORE/DAY TO THE MILL - I.E., 50 TIMES THE STONYFELL OUTPUT.

THE COST OF THE MILL IS ESTIMATED AT \$20 MILLION, ANOTHER \$20 MILLION IS REQUIRED FOR WORKSHOP, OFFICES, HOUSES, SHOPS, SCHOOL AND HOSPITAL. THE ESTIMATES ALLOW FOR THE GOVERNMENT PROVIDING AN ACCESS ROAD AND POWER LINE. IT IS ESTIMATED THAT THERE WOULD BE 260 WAGE EARNERS ON SITE, OF WHICH 40 WOULD BE PRIVATE BUSINESSMEN.

THERE ARE, OF COURSE, OPPORTUNITIES TO FIND MORE ORE, BUT ON THE KNOWN RESERVES IT IS PLANNED TO TAKE 3 YEARS TO OPEN THE MINE AND TO BUILD THE PLANT, WITH PRODUCTION OVER THE NEXT 8 YEARS. IN THAT TIME, THE MINE WOULD PRODUCE \$700 MILLION OF PRODUCT, WHICH WOULD BE DISBURSED AS \$ 260 MILLION IN OPERATING EXPENSES, \$ 160 MILLION IN PRE-PRODUCTION EXPENSES, \$ 120 MILLION IN TAXES, \$ 10 MILLION IN ROYALTIES AND \$ 150 MILLION TO REPAY CAPITAL AND PROFIT.

THE HONEYMOON DEPOSIT HAS IN A SIMILAR WAY BEEN FORMED BY DRAINAGE OF THE EAST/WEST RIDGE TO BROKEN HILL OUT TO LAKE FROME. IT IS OWNED BY MT ISA MINES AND THE MTA JOINT VENTURE. MTA IS THE OPERATOR. THE SAND AND CLAY FILLED CHANNEL IS COMPLETELY UNDER THE PRESENT PLAIN. THE SAME CLAY BANDS WHICH CONFINED URANIUM SOLUTIONS IN THE FORMATION STAGE, CAN BE USED TO CONFINE LEACH SOLUTIONS FOR AN IN-SITU EXTRACTION METHOD. THIS SYSTEM HAS BEEN USED IN A NUMBER OF MINES IN USA IN RECENT TIMES. AMDEL STAFF HAVE VISITED THESE OPERATIONS, AND WITH STAFF FROM MTA AND MT ISA, HAVE CONDUCTED PRELIMINARY TESTS

SLIDE 6

AT HONEYMOON. THE LEACH SOLUTION CAN BE ACID OR ALKALI, BUT PRESENT TESTS INDICATE AMMONIUM CARBONATE AND PEROXIDE GIVE THE BEST ECONOMICS. THE TESTS PROVIDED THE FIRST AUSTRALIAN YELLOW CAKE BY THIS PROCEDURE.

(SAMPLE)

THE MAIN OREBODY IS AT 100 M WITH AN AVERAGE THICKNESS OF 4.3 M. THE DEPOSIT IS 350 M X 250 M.

SLIDE 7

SLIDE 7 SHOWS - IN OUTLINE - THE LEACH AND PRECIPITATION PROCESS. THE RESERVES ARE 2500 TONS OF U_3O_8 AND AT LEAST TWO OTHER SIMILAR DEPOSITS OF 1000 TONS ARE KNOWN.

SOLUTION MINING HAS NEGLIGIBLE EFFECT ON SURFACE ENVIRONMENT - THE MAIN CONCERN IS CONTAMINATION OF GROUNDWATER. THE PRESENT GROUNDWATER IS ALREADY UNFIT FOR HUMAN CONSUMPTION DUE TO SALINITY AND HIGH RADON CONTENT. THE SURVEY OF WATER, FLORA, RADON AND OTHER PHENOMENA IS BEING PURSUED.

AN ADVANTAGE OF THIS PROPOSED OPERATION IS THAT IT COULD BE IN PRODUCTION WITHIN 12 MONTHS. THE INITIAL PLANT WILL RECOVER 150 TONS/YEAR, REQUIRING ONLY TWO SHIFTS OF 10 - 13 MEN, HOUSED IN ADELAIDE AND FLOWN IN ON ROSTER. THE SECOND STAGE WILL HAVE 500 TONS CAPACITY BY MODULAR ADDITION TO THE SURFACE PLANT, AND THE LIFE WILL BE A MINIMUM OF 5 YEARS. THE FINAL OPERATION WILL INVOLVE 40 TECHNICAL AND OTHER WORKERS, MOSTLY DOMICILED IN ADELAIDE. SOME 100 JOBS WILL BE CREATED DURING CONSTRUCTION. AT FULL PRODUCTION, INCOME OF \$ 33 MILLION PER YEAR WOULD BE PRODUCED. ROYALTIES WOULD BE \$1 MILLION PER YEAR.

THE THIRD AND MOST IMPORTANT FOR SOUTH AUSTRALIA, IS THE OLYMPIC DAM DEPOSIT ON ROXBY DOWNS.

SLIDE 3

THE PHOTOGRAPH SHOWS THAT THIS IS A BLIND DEPOSIT. IT IS OF ENORMOUS SIZE BY ANY STANDARDS. IT WILL HAVE TO BE MINED ON A LARGE SCALE, AND WILL HAVE A MAJOR IMPACT ON THE ECONOMY OF THE STATE.

TO PURSUE THE TECHNICALITIES OF THIS DEPOSIT FURTHER:

IF IT IS DECIDED TO USE OPEN-CUT MINING ON THIS SCALE, IT IS OF SUCH A MAGNITUDE THAT AN ENORMOUS AMOUNT OF PRE-PRODUCTION EXPENDITURE WILL BE REQUIRED. ON THE OTHER HAND, UNDERGROUND MINING COULD BE USED INITIALLY IN HIGHER GRADE AREAS TO PROVIDE SOME CASH TO SUPPORT THE VENTURE.

THE MINERALOGICAL ASSOCIATION IS UNUSUAL: A FERRUGINOUS BRECCIA, WITH COPPER SULPHIDES, URANIUM OXIDES, GOLD, SILVER, RARE EARTHS, BARYTES AND FLUORSPAR. INDICATIONS ARE THAT WE SHOULD NOT BE EXCITED ABOUT THE THREE LATTER MINERALS AND THE MANY TRACE METALS PRESENT; EXCEPT THAT THEY TEND TO COMPLICATE EXTRACTION PROCESSES. INCIDENTALLY, FLUORSPAR IS REQUIRED IN URANIUM ENRICHMENT PROCESSES.

THE GRADE OF THE COPPER IS 1 - 4 PER CENT, THE URANIUM 0.4 KG/TON, THE GOLD 1 GRM/TON. THE VALUE PER TON OF ORE IS APPROXIMATELY \$ 10 FOR COPPER, \$ 35 FOR URANIUM AND \$ 10 FOR GOLD. THE MINE WOULD BREAK-EVEN AT ABOUT 75 000 TONS OF COPPER/YEAR - REQUIRING A MINING RATE OF 15 000 TONS PER DAY TO GIVE DOUBLE THIS TONNAGE.

THE PLAN IS TO CRUSH AND GRIND THE ORE, AND RECOVER A COPPER CONCENTRATE FOR SMELTING. THE FLOTATION RESIDUE WILL NEED TO BE LEACHED WITH SULPHURIC ACID FOR RECOVERY OF THE URANIUM. THE FLOTATION CONCENTRATE WILL PROBABLY BE RAILED TO A COASTAL SMELTER, AND SULPHURIC ACID MADE FROM THE SMELTER GASES. THIS ACID WILL IN PART BE SHIPPED BACK TO THE MINE, AND IN PART USED FOR LEACHING THE SMELTER SLAG.

THE CAPITAL REQUIREMENT ON THIS SCALE IS \$ 7000 / ANNUAL TON OR \$ 1000 MILLION. THIS MEANS A WORKFORCE OF 5000 PEOPLE, SAY 3000 AT THE MINE WITH A TOWNSHIP OF 10 - 15 000. THE MINE TOWN WOULD BE COMPARABLE WITH Mt ISA. THE LIFE OF THE MINE IS INDICATED AT APPROXIMATELY 50 YEARS.

SLIDE 9

SOME IDEA OF THE IMPACT OF LARGE PROJECTS CAN BE GAINED BY COMPARISON WITH THE EXPANSION PROGRAMME AT HAMERSLEY, WHICH WAS \$ 350 MILLION. OF THIS, 11 % WENT OVERSEAS, 63 % TO W.A. AND 26 % TO OTHER STATES. OVER 700 CONTRACTS INCLUDED 25 CONTRACTS OVER \$ 3 MILLION, AND OVER 500 LESS THAN \$ 100 000. THESE WERE SPREAD IN VALUE 49 % TO MANUFACTURING (MACHINERY, METAL, TRANSPORT) AND 39 % TO SERVICES (CONSTRUCTION, FINANCE ETC.). THIS AMOUNTED TO 7 % OF THE MANUFACTURING LABOUR FORCE, AND 15 % OF THE CONSTRUCTION IN W.A.

AN IDEA OF THE TIME TO BRING IN A LARGE MINE CAN BE CHECKED WITH THE \$ 300 MILLION BOUGAINVILLE OPERATION, WHICH IS FOR 100 000 TONS OF ORE AND 250 000 TONS OF OVERBURDEN PER DAY.

SLIDE 10

OVER 5 YEARS WERE TAKEN IN EXPLORATION AND EVALUATION. AT THE END OF THAT TIME, THE MARKETING AND FINANCE REQUIREMENTS WERE CHECKED, THEN DETAILED ENGINEERING AND CONSTRUCTION TOOK AN OVERLAPPING 3 YEARS. HEAVY EXPENDITURE DID NOT TAKE PLACE UNTIL THE SIXTH YEAR, THEN ROSE RAPIDLY FOR 3 YEARS TO THE TOTAL OF \$ 380 MILLION.

FROM THE INITIAL GOVERNMENT APPROVAL TO GO AHEAD, OLYMPIC DAM WILL REQUIRE 3 YEARS OF PLANNING TO APPROACH THE MARKET, RAISE FUNDS AND SECURE CONTRACTS, DURING WHICH TIME THERE WILL BE A CRASH DRILLING PROGRAMME AND PILOT PLANT TESTS - ALL OF WHICH ARE ALREADY PLANNED. THIS WILL COST \$ 50 - 70 MILLION. CONSTRUCTION OVER THE NEXT 3 YEARS WILL TAKE \$ 300 MILLION PER YEAR. FROM THEN ON THE PLANNED OUTPUT WILL BE \$ 825 MILLION PER YEAR, OF WHICH SOME \$ 250 MILLION WOULD REMAIN IN THE STATE IN OPERATIONAL EXPENSES, AND \$ 10 MILLION IN ROYALTIES.

IN THE WHOLE HISTORY OF SOUTH AUSTRALIA WE HAVE NEVER HAD SUCH A DRAMATIC FIND. IT IS AN ENTIRELY NEW MINING PROVINCE OF WORLD IMPORTANCE. THE FIGURES INDICATED ARE ACHIEVABLE NOW - AND THEY ARE ONLY A START!

MUCH HAS BEEN WRITTEN OF A MULTIPLIER EFFECT OF ANY BUSINESS. IN CANADA, 1.2 % OF THE LABOUR FORCE IS ENGAGED IN MINING, BUT SOME 20 % OF THE COUNTRY'S GROSS DOMESTIC PRODUCT IS DEPENDENT ON THE OUTPUT. FACTORS OF 8 OR 10 TO 1 ARE OFTEN USED, IN THE CASE OF ROXBY, WE COULD EXPORT THE CRUDE COPPER AND URANIUM, BUT THE OPPORTUNITY EXISTS TO UPGRADE THIS TO MORE VALUABLE PRODUCTS, WITH INCREASED EMPLOYMENT.

IN THE CASE OF URANIUM, THIS MEANS TO ENRICH OXIDE, THE RAW MATERIAL OF ATOMIC POWER HOUSES. VERY BRIEFLY, THE POSITION IS THIS:

THERE ARE 200 POWER HOUSES OPERATING, 200 BEING BUILT, 100 ON FIRM ORDER AND 300 IN ADVANCED PLANNING STAGE - THESE ARE SPREAD THRU 47 COUNTRIES, AND DO NOT INCLUDE AUSTRALIA.

SLIDE 11

THE BEST ESTIMATE OF ENRICHMENT REQUIREMENTS IS GIVEN BY THE URANIUM INSTITUTE IN FEBRUARY. THIS SHOWS ROOM FOR AUSTRALIA AT A MODEST 0.3 SNU FROM 1987 - SAY 600 TONS OF URANIUM.

WE HAVE A CHOICE OF HIGH ENERGY DIFFUSION PLANTS, FAVOURED BY N.S.M., OR THE MORE EFFICIENT CENTRIFUGES. HERE WE HAVE A CHOICE OF THE UNTRIED JAPANESE AND US MODELS, OR THE PROVEN URENCO UNITS. SINCE BUSINESS IN THE EARLY YEARS WOULD BE WITH THE EEC, THE URENCO UNITS MAKE MOST SENSE. THE CAPACITY CAN BE PHASED IN GRADUALLY.

A PROGRAMME WHICH WOULD PROBABLY BE ACCEPTABLE TO THE EUROPEANS WOULD BE TO UPGRADE 500 - 600 TONS PER YEAR IN THE MID 80'S, RISING TO, SAY, 4000 TONS BY 1990. THIS REQUIRES PLANTS TO CONVERT OXIDE TO FLUORIDE, AND A CENTRIFUGE PLANT. IF CAPITAL EXPENDITURE STARTED NOW, IT WOULD REQUIRE \$ 750 MILLION OVER 8 YEARS. HOWEVER, INCOME WOULD START IN THE FOURTH YEAR AT \$ 50/KILO U - \$ 25 MILLION. THIS IS ADDITIVE TO THE MINED VALUE OF URANIUM. THIS WOULD SUBSEQUENTLY CLIMB TO \$ 200 MILLION PER YEAR, OF WHICH, SAY, \$60 MILLION WOULD FLOW TO THE STATE IN OPERATIONAL EXPENDITURE. THE JOB WOULD REQUIRE 100 MEN IMMEDIATELY, RISING TO 450 AT THE PEAK OF CONSTRUCTION.

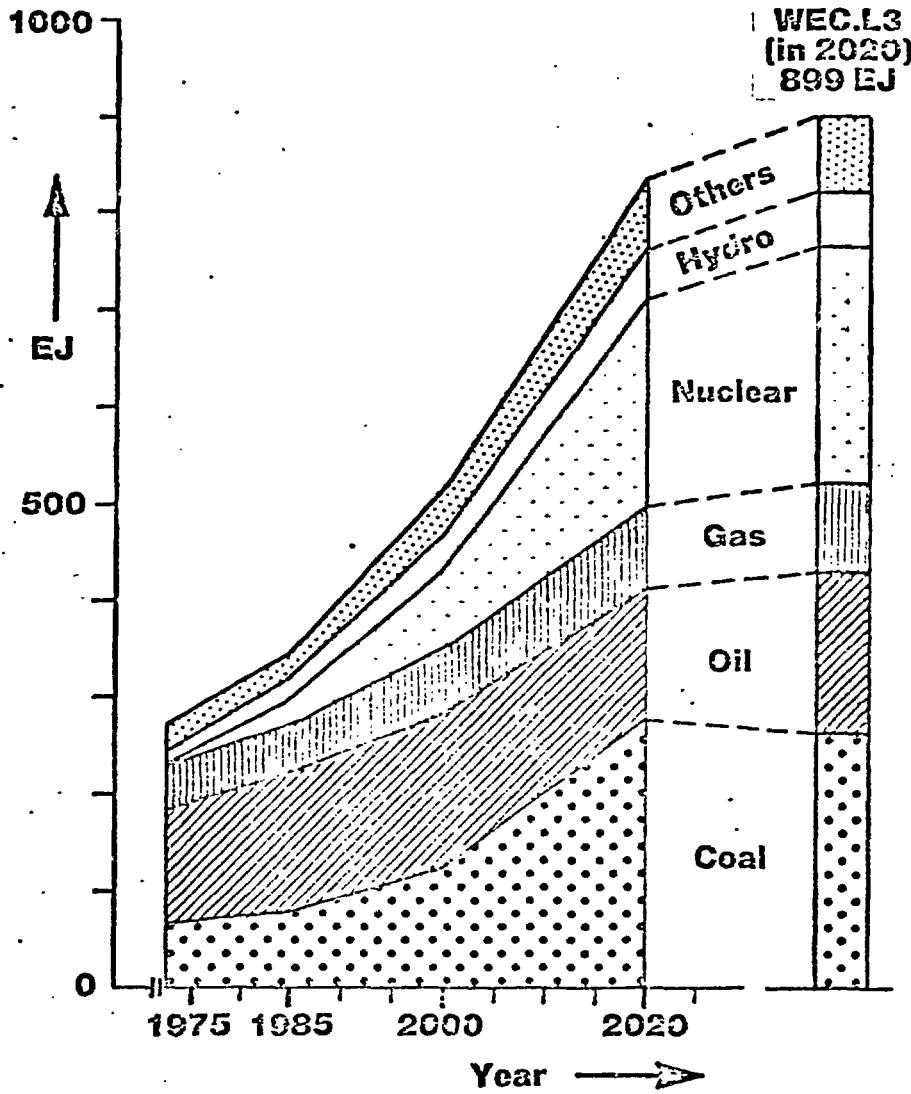
NORMAL OPERATIONS WOULD REQUIRE 350 MEN. A TYPICAL SPIN-OFF WOULD BE A \$ 30 MILLION/YEAR MANUFACTURE OF REPLACEMENT CENTRIFUGES.

IN SUMMARY, THE OPPORTUNITIES ARE LISTED AS FOLLOWS :-

SLIDE 12

ABOUT \$ 2000 MILLION DOLLARS OF CAPITAL, WITH 2-3000 CONSTRUCTION JOBS OVER FIVE OR MORE YEARS, LEADING TO FIVE THOUSAND PERMANENT JOBS ON THE OPERATIONS ALONE, WITHOUT THE SPIN-OFF OF THE MULTITUDE OF CONTINUED MANUFACTURING AND SERVICES ASSOCIATED WITH THE PROJECTS. THESE ARE NOT IMPOSSIBILITIES - THE ORES HAVE BEEN FOUND, THE PROCESSES DETERMINED, THE MARKETS ARE READY!

TABLE 1



FUTURE WORLD ENERGY DEMAND (WEC.L4)

TABLE 2

UNCERTAINTIES IN SHORT-TERM URANIUM REQUIREMENTS

- (a) Stockpiling policies**
- (b) Requirements for enrichment**
- (c) Cost of production relative to oil and coal**
- (d) Levels of sustained economic growth**
- (e) Availability of Technical personnel**
- (f) Opposition to nuclear power**
- (g) Non-proliferation policies**

TABLE 3

URANIUM INSTITUTE ESTIMATES - JANUARY 1979

URANIUM PRODUCTION 1973 - 1990

(1000 TONNES U / YEAR)

	1978	1979	1980	1981	1982	1983	1984	1985	1990
AUSTRALIA	0.48	0.5	0.5	0.5	1.4	3.9	5.8	11.8	13.6
BRAZIL	-	-	0.2	0.2	0.4	0.4	0.5	0.5	1.0
CANADA	6.6	7.0	7.3	7.9	8.9	8.9	9.1	9.2	12.0
CAE	-	-	-	-	-	-	-	0	0
FRANCE	2.27	2.6	2.6	2.6	2.6	2.8	3.0	3.0	3.5
GABON	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.2	1.4
MEXICO	-	0.1	0.2	0.4	0.4	0.5	0.6	0.6	0.8
NIGER	2.2	3.3	3.3	4.0	4.3	5.0	5.0	6.0	8.0
SOUTH AFRICA & NAMIBIA	7.2	9.5	10.8	11.3	11.6	11.7	11.8	11.5	12.0
SPAIN	0.2	0.4	0.4	0.6	0.6	0.6	0.6	0.8	0.8
USA	14.4	16.3	17.5	18.5	19.0	19.0	18.0	18.0	24.0
OTHER*	0.6	0.8	0.8	0.8	1.0	1.4	1.5	1.5	1.5
TOTALS:									
(ANNUAL)	34.9	41	44	48	51	55	57	64	78
(CUMULATIVE)	35	76	120	168	219	274	331	395	760

* ARGENTINA, FEDERAL REPUBLIC OF GERMANY, INDIA, ITALY,
JAPAN, MEXICO, PHILIPPINES, PORTUGAL, SWEDEN, TURKEY,
YUGOSLAVIA.

TABLE 4

NEW URANIUM MINE DISCOVERIES REQUIRED BY 2015

Large low-grade (Rossing) (Olympic Dam)	12
Medium Size (New Mexico)	78
Large low-grade underground (Denison - Canada)	8
Medium Size underground (Radium Hill)	60
Large high-grade open pit (Ranger)	27
Small medium-grade (Wyoming) (Honeymoon)	144
	<u>329</u>

TABLE 5

BEVERLEY DEPOSIT - ORDER OF MAGNITUDE

CAPITAL:

Mining	\$25 million
Mill	20
Workshop/School/Hospital/Town	20
Total	\$65 million

OPERATION:

Operating Expenses	\$260 million
Pre-Production Charges	160
Taxes	120
Royalties	10
Repay Capital and Profit	150

VALUE OF PRODUCT

\$700 million

SCHEMATIC URANIUM LEACH AND RECOVERY SYSTEMS

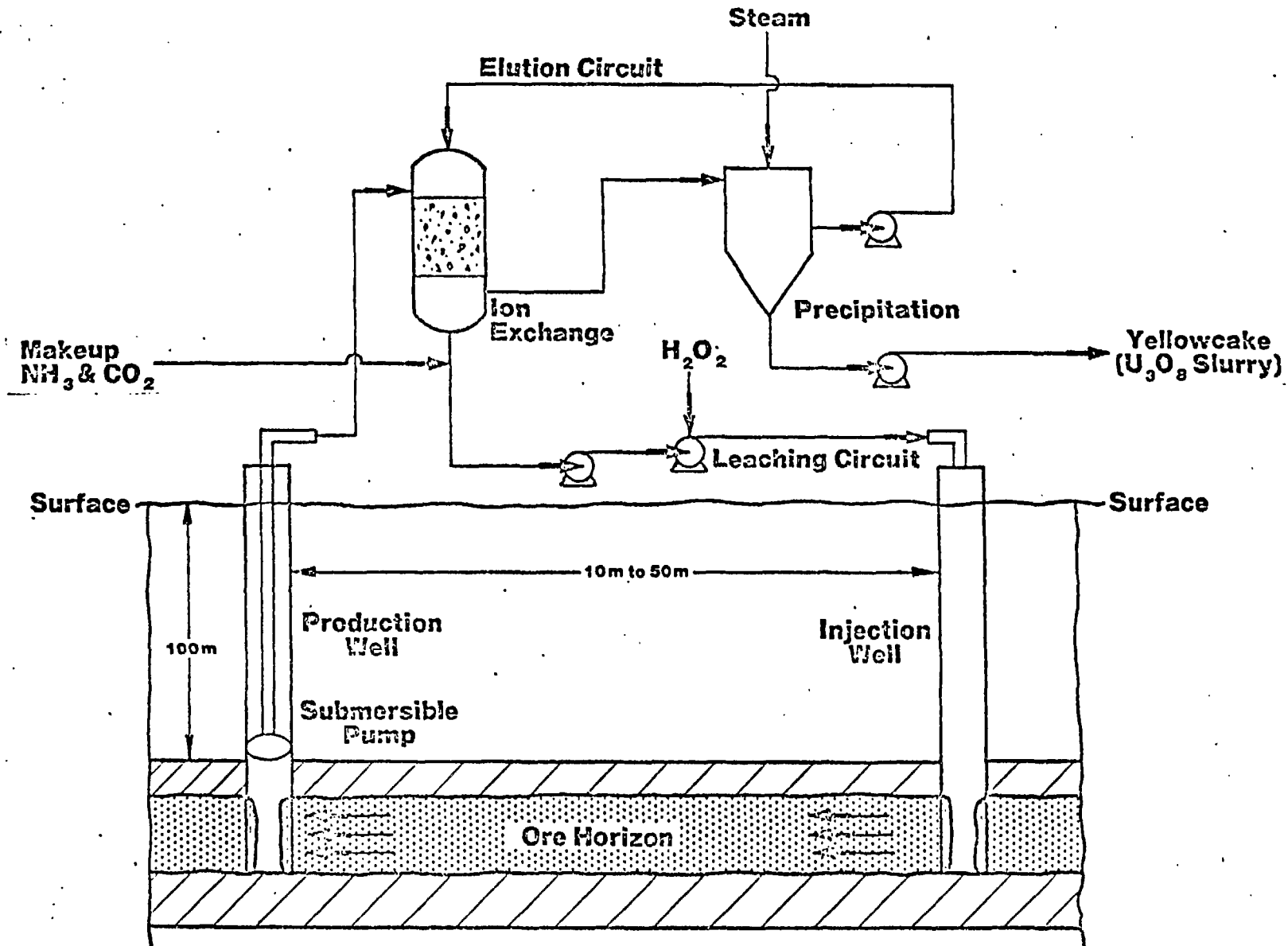


TABLE 7

TABLE 9

DISTRIBUTION OF HAMERSLEY EXPANSION COST

WA	63%	}	Manufacturing	49%
Other States	26%		Services	39%
			Others	1%
Overseas	11%			

TOTAL COST: \$350 million

TABLE 10

BOUGAINVILLE CONSTRUCTION

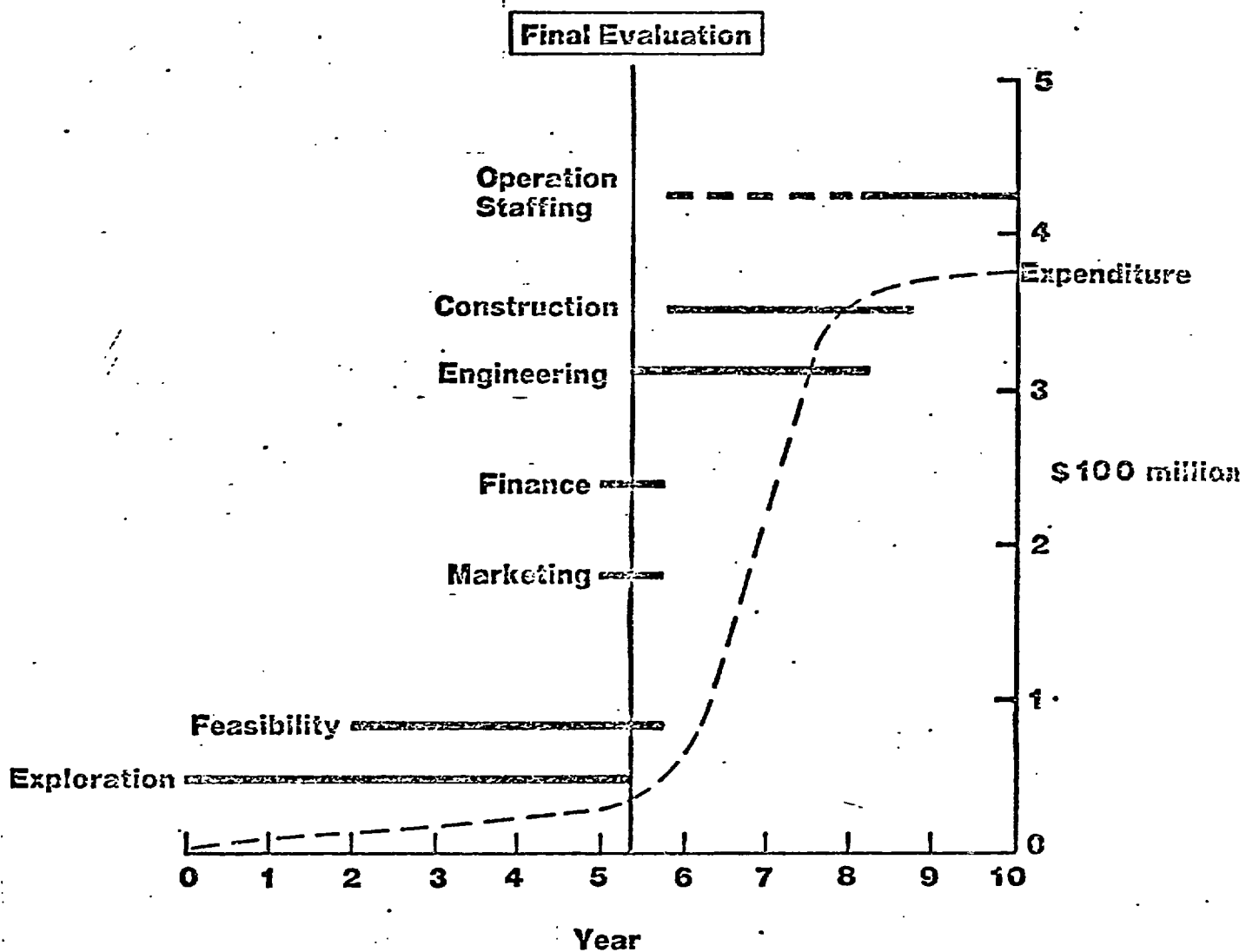


TABLE 11

FORECAST ENRICHMENT CAPACITY: 1973 - 1990 (10⁶ SWU / YEAR)

URANIUM INSTITUTE ESTIMATES

JANUARY 1979

	1978	1979	1980	1985	2986	1987	1988	1989	1990
US DOE DIFFUSION	12.7	14.9	20.2	25.3	25.6	26.1	26.2	25.8	25.3
US DOE CENTRIFUGE	-	-	-	-	-	0.4	1.1	2.2	2.2
EURODIF	-	2.3	6.1	10.8	10.8	10.8	10.8	10.8	10.8
COREDIF	-	-	-	-	2.5	4.0	5.0	2.0-5.0	3.0-8.0
URENCO	0.3	0.4	0.4	2.0	2.3-2.5	2.6-3.5	2.9-4.5	3.2-6.0	3.5-7.5
BNFL DIFFUSION	0.4	0.4	0.4	-	-	-	-	-	-
SOUTH AFRICA	-	-	-	-	-	0.2	0.2-0.3	0.2-0.3	0.2-0.3
AUSTRALIA	-	-	-	-	-	0.3	0.3	0.3	0.3
BRAZIL	-	-	-	0.2	0.5	0.2-0.5	0.2-1.0	0.2-2.0	0.2-2.5
JAPAN	-	-	-	0.1-0.3	0.1-0.5	0.1-0.5	0.1-1.3	0.1-1.9	0.1-2.5
SJB TOTAL	13.4	18	27.1	38.2- 38.6	38.8- 42.4	39.9- 46.3	41.5- 50.5	44.5- 54.3	45.3- 59.4
USSR EXPORTS	3.0	3.0	3.0	3.0-4.0	3.0-4.0	3.0-4.0	3.0-4.0	3.0-4.0	3.0-4.0
TOTAL (ROUNDED)	16	21	30	41-43	42-46	43-50	45-55	48-58	48-63

TABLE 12

**OPPORTUNITIES FOR URANIUM DEVELOPMENT IN
SOUTH AUSTRALIA**

\$ million	Beverley	Honeymoon	Olympic Dam	Enrichment	Total
Capital	65	40	1000	750	1855
Annual Production	90	38	825	200	1153
Operation Costs in Sth. Aust.	25	10	250	60	345
Royalties/yr	2	1	10	—	13
Project Life	8	5	50	50	—
Employed					
Construction	200	100	1500	450	—
Operation	260	40	5000	350	5650

