NRC Visit to Almelo 16 / 17 / 18th March 2004-03-01

Agenda

Venue	Technicon (Almelo Gate 1)				

Tuesday 16th March

0830	NRC collected from Hotel	
0840	NRC provided with site visitor passes at security gate and escorted to Technicon	H Voschezang
0850	Introduction	P de Jong,

Present (non UEC)

H Felsher	(NRC)	R Krich	(LES)
R Pierson	(NRC)	M Lynch	(ETC)
B Smith	(NRC)	A Brown	(ETC)
W Troskoski	(NRC)	P Hale	(ETC)
M Kennedy	(Ariva)	A Waring	(ETC)

0930	Site Tour	H.Voschezang
	Present As Introduction	
1200	Lunch	P de Jong
	Present As Introduction	
1300	Equipment operating experience	H.Voschezang
	Present As Introduction	
1530	Depleted uranium disposition and transport	B Dekker
	Present As introduction	
1700	Close	

Wednesday 17th March

0900 Classified Integrated Safety Assessment Including Cascade, Dump, Test and Post Mortem facilities.

Present As introduction plus

R Wheeler	(ETC)
S Thomas	(ETC)
A Pilkington	(ETC) RMC

0900 SP5 Construction Tour

Present R Krich, M Kennedy, NRC personnel to be nominated.

Attachment 2

1200	Lunch		
	Present	All	
1300	Radiation protection and regulatory requirements		M van Wijnkoop
	Present	As Introduction	
1500	Effluents / Wastes and regulatory requirements		M van Wijnkoop
	Present	As Introduction	
1700	Close		

Thursday 18th March

0900	Criticality safety approach (for LES Project)		A.Brown
	Present	As Introduction	
1100	SP5 and site water consumption		H Voschezang
	Present	As Introduction	
1200	Lunch		
	Present	As Introduction	
1300	Summary.		
	Present	All	
1400	Close		

Note

Agenda item progress may affect actual start / stop times.

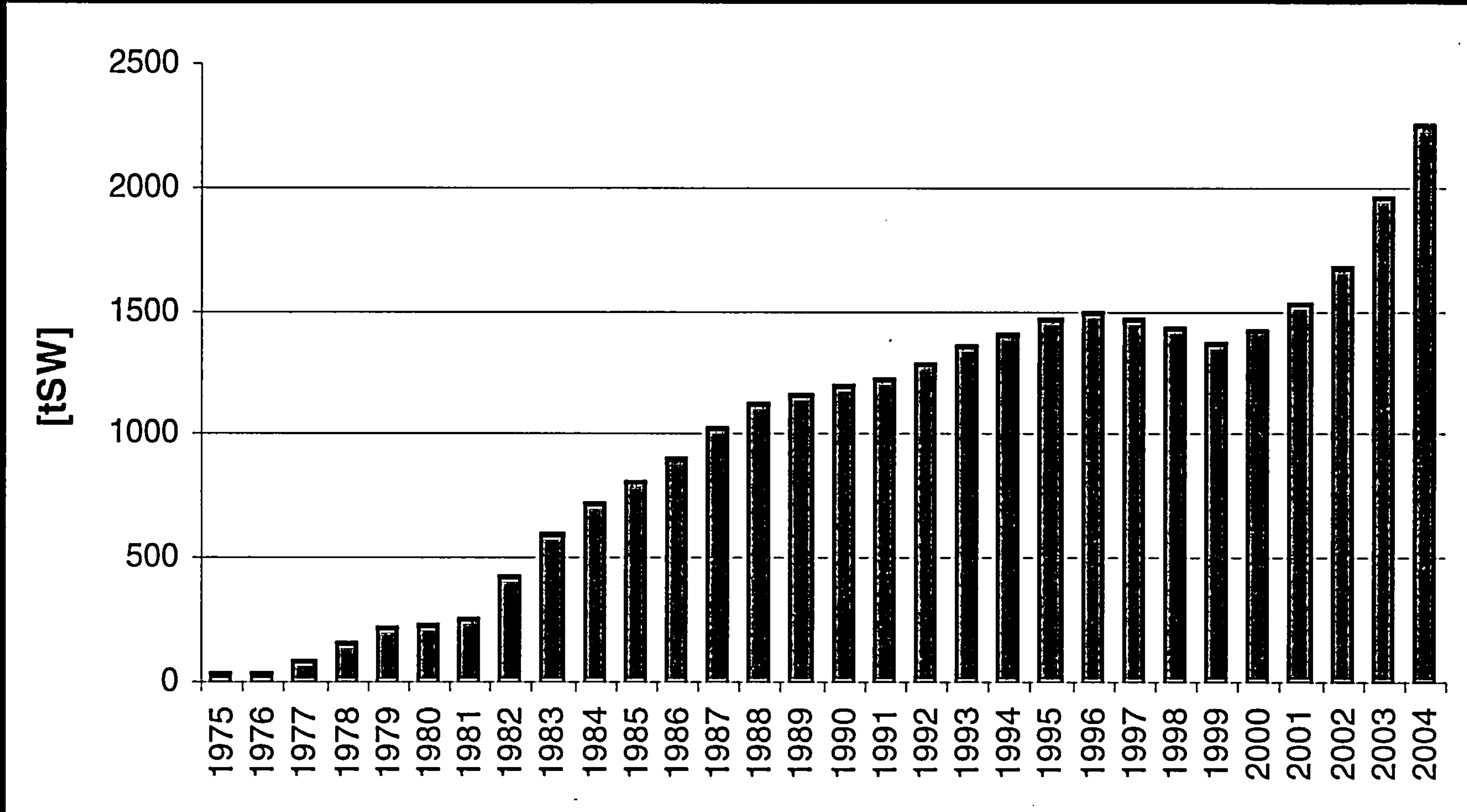
Uranium hexafluoride

- Feed, Enriched and Depleted Uranium
- Receipt, Dispatch and Storage

Ben G. Dekker
Urenco Nederland B.V.

Attachment 3

Plant production Almelo: 1975-2004



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UF6 quantities processed

Plant	Operation	tU Feed	tU Enriched	tU Depleted
SP1	1974-1981	210	30	180
SP2	1974-1994	700	100	600
SP3	1976-present	7000	1000	6000
SP4	1981-present	37100	5300	31800
SP5	2000-present	2100	300	1800
Total		47210	6730	40480

↓

ca. 59000 tUF6

↓

ca. 4750
48" cylinders

Storage limits 3500 tSW license

t UF6	Limit quantity	Today's quantity
Feed	6500	1350
Enriched	1500	200
Depleted	37500	6000

Obligations for outside storage yards

- Limits for quantity of UF6
- Minimize quantity of depleted UF6
- End of project -> green field situation
- Limits for radiation at site boundary
- Inspection regime (long term storage)
- Effluent control

Options for depleted uranium

Chemical form	Option	Use
UF6	• storage on site • storage elsewhere	• long term storage • re-enrichment
U3O8	• storage on site • storage elsewhere	• long term storage • use as oxide • use as metal uranium

History of depleted uranium

(total quantities in t UF_6)

- Produced till today: ca. 59000
- Shipped out for re-enrichment: ca. 40000
- Shipped out for defluorination: ca. 1000
- Returned to customers: ca. 12000
- Current stock: ca. 6000

→ ca. 500 48” cylinders

Cylinders for UF6

- Cylinder standards
  - ANSI N 14.1
  - ISO 7195

- Cylinder types
  - 30 B (for external transport loaded in overpack)
  - 48Y
  - 48G: use terminated (transferred into 48Y)

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Transport of UF6

- On site
  - Straddle carrier
  - Forklift truck
- Off site (IAEA Transport Regulations TS-R-1)
  - Trucks
  - Rail *)
  - Sea *)

*) not *direct* to and from UNL

Equipment Operating Experience

March , 2004

Urenco Netherlands

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Enrichment Technology

Summary

- For most equipment more than 30 years of equipment experience
- None of the described accident sequences occurred
- Improvements implemented in SP5 design
- Cylinder overfilling is a discussion point

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Arranged by Subjects

1. Failure heater control
2. Overfilled Cylinder
3. Hex/Uranic-release due to failures
4. Wrong Cylinder connected
5. Criticality in Product Pumps
6. Criticality in Cylinders
7. Criticality in Storage
8. Saturated Carbon traps
9. Criticality in GEVS

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Failure heater control

- Feed Chests
- Low Temperature Take-off Stations
- Cold Traps
- Blending Donor Station
- Sampling Autoclave
- Sub Sampling

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Feed Chests

- SP5, 10 Feed Chests / SP4, 1 Test Station
- >30 years
- No Incident with Heater remaining on
- Blending Donor Chests and Feed Chests are the same Design

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Incident in Autoclave SP4

Cause: Blockage Cylinder Valve

- Autoclave: or Pressure or Temperature Control

Improvement to Feed Chest in SP5:

- and Control and Capillary (hardwire)
- and Air Temperature (hardwire+software)
- and Pressure (software)
- and Cylinder Wall Temperature (software)

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Low Temperature Take-off Stations

- 18 Tails Stations
- 10 Product Stations
- 4 Feed Purification Stations
- 1 Test Station in SP4
- ≥ 30 years
- No Incident
- Receiver Stations Blending same Design.

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Cold Traps

- 8 Cold traps SP5
- 5 Cold traps SP4
- 2 Cold traps SP3
- 2 Cold traps Blending
- > 30 years
- No Incident

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Sampling Autoclave

- 5 Sampling Autoclaves Blending
- > 30 years (both hot water & electrical independently)
- No Incident with Hot Water Heater
- No Incident in Gronau with Electrical Heater

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Sub Sampling

- One Sub Sampling Device
- > 30 years
- No Incident

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Over Filled Cylinder

- > 30 Years (no incidences of a safety concern)
- Two Tails Over Fillings in SP5 2001
- Maximum Filling 48 Y 12500 kg.
- One Cylinder 12635 kg.
- One Cylinder 12574 kg.
- Causes - Defect Load cells
- Other Type Load cells installed
- Improvement : Total Mass Check every Hour (End 2004)

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Hex/ Uranic Release due to Failures

- Never due to saturated Carbon traps
- Never in Sampling Autoclave
- Once during Cylinder Valve Change
- Unloading Carbon- and Aluminium Traps, no consequences to the Worker
- Early Stage of Sub Sampling, no consequences to the worker

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Hex/ Uranic release due to Failures

- >> 30 years
- Only Traces of Hex in Vacuum Pump Oil
- No HEX to the GEVS via Pumps
- No Consequences to Workers
- 4 years of Operation SP5 No Release, whole Hex System Sub Atmospheric Pressure

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Wrong Cylinder Connected

- >> 30 years
- No Product Cylinder connected to Feed System inadvertently
- No filled Product Cylinder connected in Cylinder Preparation

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Criticality in Pumps

No exceptional Amount of Hex in:

- Low Pressure Pumps
- Vacuum Pumps
- SP4 , SP5 , Blending , Mobile Pumps
- Only Traces of Uranics
- > 30 years

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Criticality in Cylinders

No excessive Moderator in:

- Product Cylinders
- Donor Cylinders
- Receiver Cylinders
- Product Cylinders in Cylinder Preparation
- > 30 years

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Criticality in Cylinders

- All Cleaned and Washed out Cylinders are checked.
- All heeled Cylinders come from qualified Suppliers
- In the future, supplier of new Cylinders will be qualified

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Criticality in Tanks and Storage

No Accumulation of Sufficient Uranium Mass to Cause Criticality in:

- Chemical Trap
- Waste Treatment Tanks
- Waste Collection Tanks
- Oil Storage
- > 30 years

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Possible Causes Loading CarbonTraps

- Leaking Cold Trap Outlet Valves
  - Feed Purification
  - Product Venting
  - Product Blending
- Also during Gas Back Mode
- >30 years (SP4 & SP5)

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Saturated Carbon Traps

1. In SP5:
2. 4 Carbon Traps in Feed Purification
3. 4 Carbon Traps in Product Venting
4. 2 Carbon Traps in Tails Evacuation
5. 2 Carbon Traps in Mobile Rigs
6. SP4 in total more than 10 Carbon Traps
7. No saturation in > 30 years

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Carbon Traps SP5 Hall 1

System	Increase 03	Total 4 years
Feed Purification	2.7 kg.	7.3 kg.
Feed Purification	1.4 kg.	5.4 kg.
Product Venting	0.2 kg.	3.3 kg.
Product Venting	2.5 kg.	4.7 kg.
Tails Evacuation	1.8 kg.	5.75 kg.

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Carbon Traps

- Carbon Weight 12-13 kg.
- Nominal Maximum Hex Load is 100%
- Theoretical Maximum Hex Load 200-300 %.
- No Hex through the Carbon Trap.

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Uranic Build up in GEVS

- Never due to saturated Carbon Traps
- Small Amounts from Flexible Trunks used during (dis-) connecting Cylinders
- Insufficient Amount of Accumulation on the Filters or Precipitators to form a Critical Mass
- GEVS Filters SP5 replaced after 4 years of Operation , not even contaminated
- SP3 , SP4 and SP5 > 30 years

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Waste-treatment Urenco NL

March 18, 2004

Urenco Netherlands

Almelo

Urenco Nederland B.V.

Contents

Introduction

- Urenco NL runs three centrifuge enrichment plants (SP3, SP4 and SP5)
- Additional areas involved in RA material handling are the CSB and CRD buildings, the SP2 (decommissioning activities) and the tails-yard
- RA waste streams are processed by two departments; PS-WT (4 pers.) and DRO (20 pers.)

Introduction

- CHA department plays an important role with regards to analyses and clearances
- All solid RA waste is stored at COVRA

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RA waste generating activities

- Decommissioning
  - centrifuges
  - piping
  - miscellaneous plant systems
  - desublimers
  - UF_6 cylinders
- Cleaning of equipment for re-use
  - UF_6 ampoules, pipettes
  - Cold traps, active carbon traps, Al_2O_3 traps
  - Vacuum pumps

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RA waste generating activities

- Cleaning of UF_6 cylinders
  - pressure certification (re-use)
  - scrap
- Analyses
  - spent samples
  - tissues, gloves, gaskets, etc.
  - cleaning of glassware, p-10 tubes, etc.
- Production and maintenance
  - tissues, gloves, gaskets, etc.
- Floor cleaning in controlled areas

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Types of RA waste-streams

- Liquid RA waste
  - Aqueous RA solutions
  - RA contaminated mineral oil
  - RA contaminated fluorinated oil
- Solid RA Waste

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Types of RA waste-streams

Liquid aqueous RA waste

- Solutions used for cleaning and decontaminating equipment
- Effluent from cylinder cleaning and vacuüm-dryer
- Varying chemical content; citric acid, nitric acid, soda, soaps, traces of oil
- Between 1-5% solids content
- In total 370 m^3 per year (2003)

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Types of RA waste-streams

Liquid aqueous RA waste

- 220 m^3 produced by decommissioning activities
- 40 m^3 produced by cleaning of equipment for re-use
- 20 m^3 produced by cylinder cleaning and pressure testing
- 50 m^3 produced by various acitivities (a.o. lab waste)
- 40 m^3 floor cleaning of controlled areas (usually <u>not</u> contaminated)

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Types of RA waste-streams

RA contaminated mineral oil

- mineral oil from pumps (both decommissioning and re-use)
- Contains small amounts of uranium contamination and cracking products (1- 1000 ppm U)
- Total of ca. 300 l per year (pre-vac. pumps)

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Types of RA waste-streams

RA contaminated fluorinated oil

- Fluorinated oil from pumps (both decommissioning and re-use)
- Mixtures of different types of oils (fomblin, tyreno)
- Contains small amounts of uranium contamination (1- 100 ppm U)
- Total of ca. 100 l per year (compressors and WSU)

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Types of RA waste-streams

Solid RA Waste

- Solid RA waste produced by processing of liquid RA streams.
- RA contaminated active carbon (mainly from active carbon traps, not GEVS)
- RA contaminated Al_2O_3
- RA contaminated auxiliaries (gloves, tissues, gaskets, wood, concrete etc.)

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Volume of solid RA waste 2003

- 30-40% with dryer material (processed liquid waste and NaDU)
- 5-10% with active-carbon and Al_2O_3
- Remaining 40-50% contains miscellaneous material

	Waste kg	MBq	Drums
2000	6100	9500	104
2001	12000	14000	193
2002	13000	7400	223
2003	11900	27740	220

Processing of RA waste

Liquid aqueous RA waste

- Storage in 10 m^3 vessels
- Concentration by means of evaporator (starting solids content ca. 5%, final content 30-40% solids)
- Destillate typically contains < 1 ppm uranium and will be disposed at sewer
- Drying of concentrate to < 1% moisture using a vacuüm-dryer
- Destillate is transferred back into 10 m^3 vessel
- Solid disposal in COVRA drums (ca. 100 l /75 kg)

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Processing of RA waste

Liquid aqueous RA waste (cylinder cleaning)

- Storage in critically safe (diameter) vessels
- Analyses of U-content and U-assay
- If U-assay < 1% and U-content < 16 kg the uranium is transfered to storage vessels and subsequently precipitated as NaDU
- Supernatant (typically < 100 ppm U) is processed by an evaporator
- NaDU precipitate is dried using a filterpress (ca 30% moisture remaining)

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Processing of RA waste

Liquid aqueous RA waste (cylinder cleaning)

- Wet NaDU is dried to < 1 % moisture by means of a plate-dryer or vacuüm-dryer
- Solid disposal in COVRA drums (ca. 100 l /75 kg)

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Processing of RA waste

RA contaminated mineral oil

- Mineral oil is collected in critically safe drums
- Analysis of U-assay and U-content
- Several batches of oil are combined (total U-content < 16 kg)
- One combined oil batch (ca. 500-1000 l) is washed with aqueous HNO_3 until U-content < 1ppm
- Aqueous washings are fed back to 10 m^3 vessel
- Oil is disposed as chemical waste (SITA)

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Processing of RA waste

RA contaminated fluorinated oil

- Fluorinated oil is collected in critically safe drums
- Analysis of U-assay and U-content
- Several batches of oil are combined (total U-content < 16 kg)
- One combined oil batch (ca. 20-30 l) is processed using a filterpress until U-content < 1ppm
- U-containing wood chippings are transferred to COVRA vessels
- Fluorinated oil is disposed as chemical waste (SITA), re-used in future

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Processing of RA waste

Solid RA waste (active-carbon and Al_2O_3)

- Active carbon contains relatively high U-contents (1-12 kg per trap)
- When U-assay < 1% the material will be disposed in COVRA drums
- When U-assay > 1% the material is devided into smaller portions (< 15 g ^{235}U) and added to material with low U-content (e.g. tissues, gloves etc.) or alternatively washed out with aqueous HNO_3
- Al_2O_3 contains far less U and can usually be disposed in COVRA drums

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Processing of RA waste

Solid RA waste (auxiliaries)

- All auxiliaries from controlled areas will be sorted based on possible contamination
  - Red refuge bags for (almost) certainly contaminated material
  - Yellow refuge bags for non-contaminated material
- Red bags are pressed into COVRA drums (5-7 per drum)
- Yellow bags will be disposed as conventionele waste after activity measurement

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Processing of RA waste

Solid RA waste (auxiliaries)

- Other (surface) contaminated auxiliaries are packed into COVRA vessels provided they do not contain any moisture
  - wood
  - filters
  - concrete
  - synthetic material
  - small equipment that can not be decontaminated

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Disposal of RA waste

- All RA waste produced by Urenco NL has to be stored on dutch territory
- COVRA is the only company in the Netherlands with a licence for storing RA waste
- All solid RA waste will be transported to and stored at COVRA

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Disposal of RA Waste

- COVRA has several acceptance criteria for solid RA waste
  - Moisture content < 1%
  - If U-assay < 1%, U-content per drum max. 75 kg
  - If U-assay > 1%, max. 15 g ^{235}U per drum
- Radiological aspects
  - Max. doserates: 2,0 mSv/h at surface, 0,1mSv/h at 1m distance
  - Max. surface contamination 0,4 Bq/cm^2 (α) and 4,0 Bq/cm^2 (β)

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Concluding remarks

- All effluent released to the environment is well below the RA limits imposed by Dutch legislation
- Approximately 60-70% of the RA waste volume of Urenco NL is generated by decommissioning and cylinder cleaning
- The various types of RA waste produced at Urenco NL can all be disposed at COVRA

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Concluding remarks

- Disposal of RA waste at COVRA requires processing of the different materials in order to meet COVRA acceptance criteria and reduce costs
- Both changes in legislation and reduction of costs necessitate continuous improvement in waste-treatment techniques

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Radiation Protection and regulatory compliance

March 18, 2004

Urenco Netherlands

Almelo

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Contents

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Introduction

- Urenco NL runs three centrifuge enrichment plants (SP3, SP4 and SP5)
- Additional areas involved in RA material handling are the CSB and CRD buildings, the SP2 (decommissioning activities) and the tails-yard
- For all nuclear installations in the Netherlands the Nuclear Law (KEW) applies

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Introduction

- Nuclear legislation is the responsibility of the Ministry of VROM
- VROM uses RIVM for all contra-expertise measurements
- Based on KEW Urenco NL has a license for 2800 tSwu/y
- Application for new license for 3500 tSwu/y

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Radioactive dose-rates

Legislation

- Normal personnel < 1 mSv/year
- Exposed personnel > 1 mSv/year
  - Category A < 20 mSv/year
    - Dosimetry + medical examination
  - Category B < 6 mSv/year
    - Dosimetry (national archive)

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Minimisation of radiation exposure (ALARA)

- Shielding
  - Transport lorry
  - Construction shielding
  - Filling empty feed cylinders with tails
- Automation
  - Remote controlled transporters and cranes
- Procedures
- Information
  - Instruction leaflets
  - Intranet

Radiation exposure of UNL personnel

Classification of workplaces

- Unrestricted acces:< 1mSv/y
- Guarded zone: >1mSv/y (1700h/y)
  - Dosimeter compulsory
- Controlled zone: >6 mSv/y or risk of contamination
  - Dosimeter compulsory
  - HFC-monitor on exit

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Radiation exposure of UNL personnel

- 106 employees are classified in category B
  - 5 employees received >1mSv (< 2mSv) in 2003

Department	Dose (mSv/year)	> 1 mSv/year
MH&D	0,4 - 2,0	4
CSP	0,1 - 1,1	1
PO-shift	0,1 - 0,9	
TES	0,0 - 0,2	

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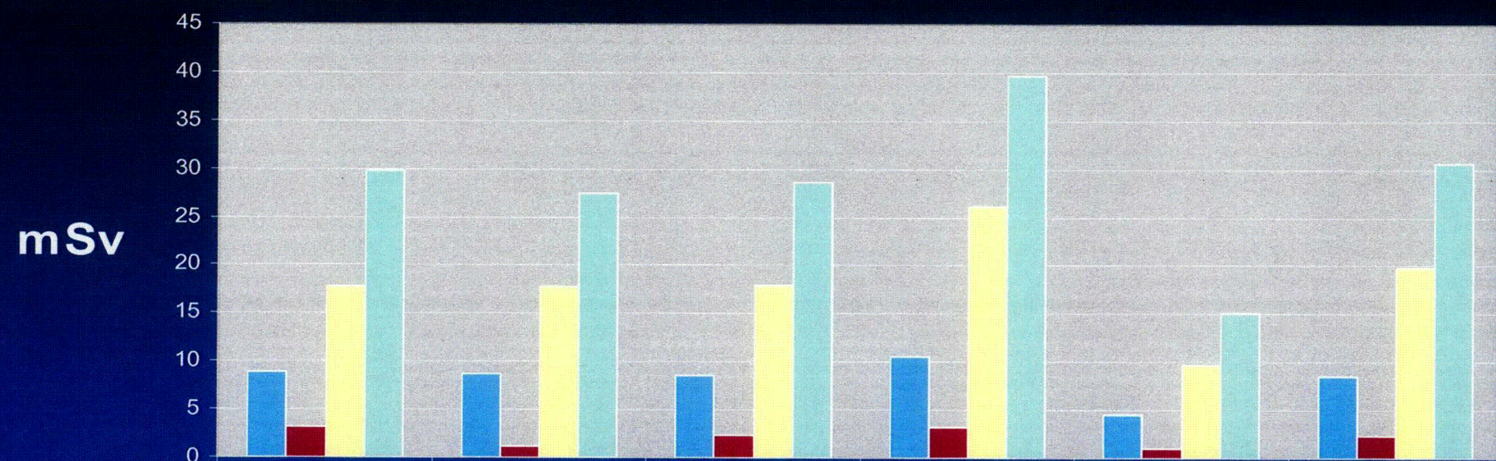
Collective dose rates 1999-2003



	1999	2000	2001	2002	first half 2003	2003
MH&D	8,84	8,72	8,46	10,5	4,51	8,61
PRO CSP	3,23	1,1	2,29	3,1	0,95	2,28
PRO shifts	17,68	17,68	17,84	26,04	9,64	19,74
SUM	29,75	27,5	28,59	39,64	15,1	30,63

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C01

Radiation exposure of UNL personnel

- Periodic urine control for employees possibly exposed to open uranium sources
  - yearly routine control (100 pers.)
  - 4x year for personnel with higher risk (30 pers.)
    - laboratory personnel
    - decommissioning personnel
- Additional urine control in case of incidents
  - 24 h monitoring
  - 1-3 cases per year

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Radiation exposure of UNL personnel

Results of additional urine control of recent years

- Majority of cases < 10 μgrU/l (no further action)
- Since 1993 2 cases with > 10 μgrU/l, urine control was followed up by an internal examination
- > 50 μgrU/l, reportable incident , none since 1993

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Radiation exposure at site borders

Legislation

- Maximum of 0,04 mSv/year
- ABC factor of 100 so effectively 4 mSv/year (485 nSv/h)
- Yearly measurement of complete site border
- Yearly measurement of highest points

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Radiation exposure at site borders

Actual data Urenco NL

- Background dose approx. 100 nSv/h
- Always below 485 nSv/h
- In 2003 < 300 nSv/h

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Airborne RA emissions

Legislation

- Max. α-activity: 5 mBq/m^3 (year average)
- Max. β/γ-activity: 500 mBq/m^3 (year average)

- peak emission α-activity: 0,5 Bq/m^3 (1 hour)
- peak emission β/γ-activity : 50 Bq/m^3 (1 hour)

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Airborne RA emissions

- Two independent systems register possible emission of UF_6 and its hydrolyses products in the stacks of the plants
  - Monitoring of α and β/γ radiation levels (10^{-3}Bq/m^3)
  - HF monitoring (10^{-3} mg/m^3)
- The stack additionally contains a probe that collects potential RA particle emissions
  - Monitoring of α and β/γ radiation levels (10^{-5}Bq/m^3)
- Regulator performs frequent (random) contra-expertise measurements on the latter samples

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Safeguards against airborne RA-emission

- The gaseous effluent from the enrichment plants and the CSB pass through a filter system before it is released into the stack
- This filter system consists of a pre-filter, an active-carbon trap and a HEPA (absolute) filter
- The filter system is either redundant or regularly checked for absorption capacity and effectiveness (DOP-test)

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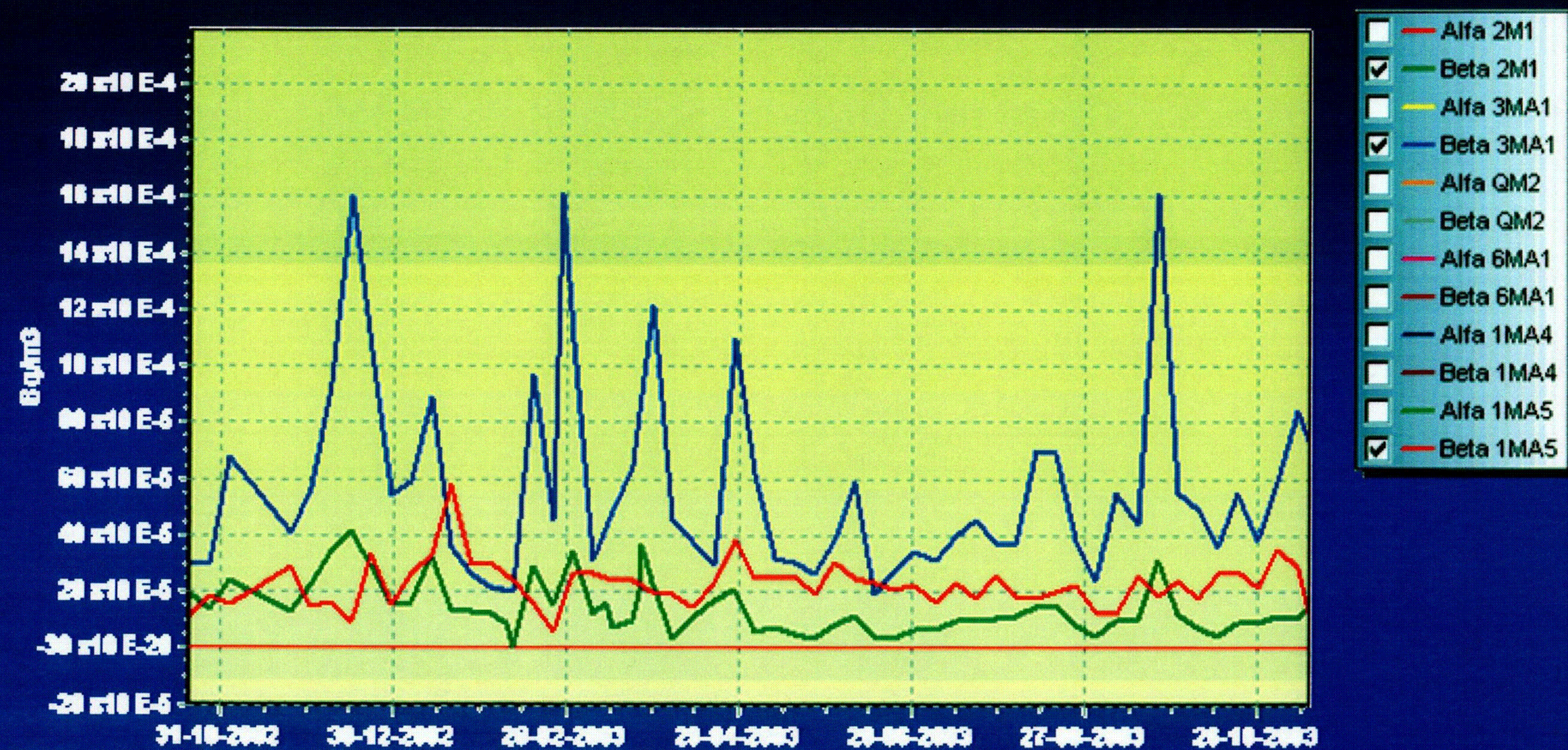
Airborne emissions trending



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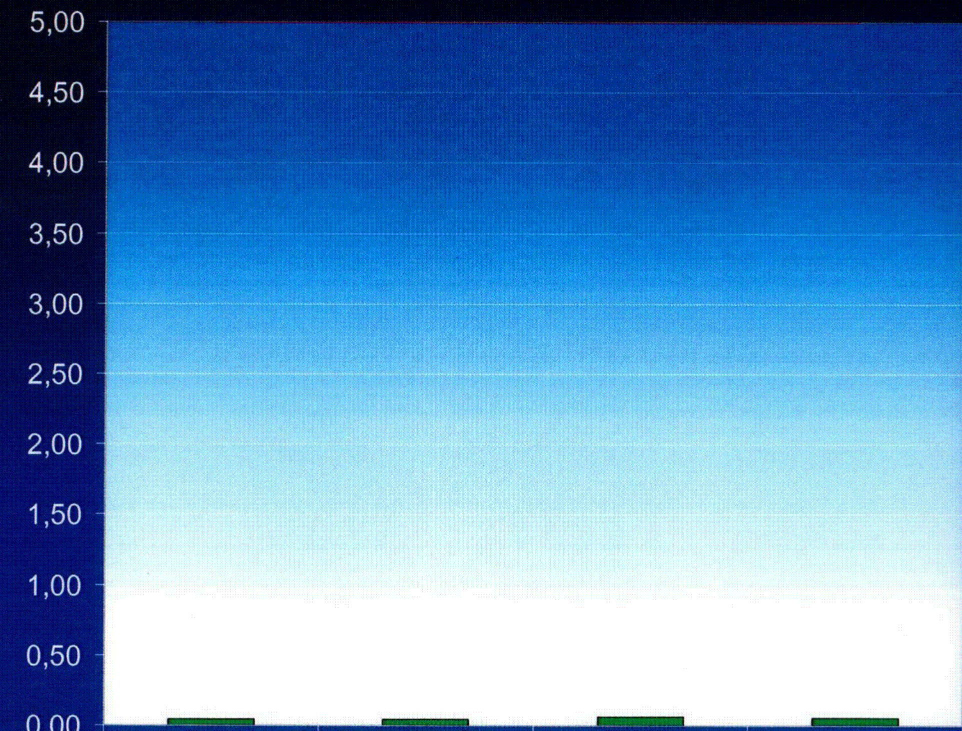
C02

Airborne RA emissions UNL



	2000	2001	2002	2003
alfa mBq/m3	0,05	0,05	0,06	0,05
alfa limit	5	5	5	5

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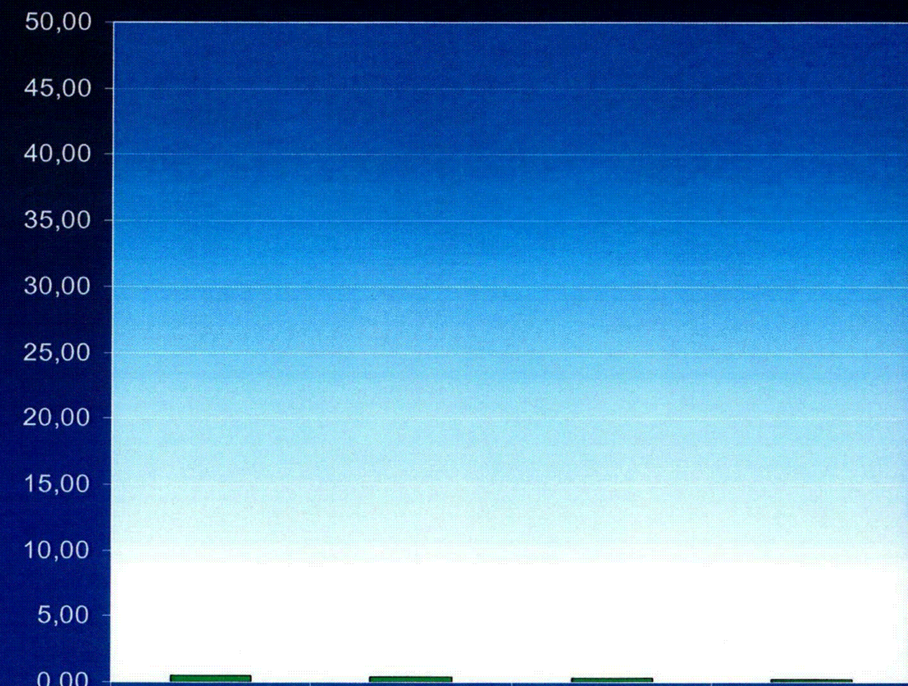
C03

Airborne RA emissions UNL



	2000	2001	2002	2003
beta gamma mBq/m3	0,46	0,41	0,32	0,22
beta gamma limit	500	500	500	500

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C04

Liquid RA emission

Legislation

- Maximum α-activity for disposal at the sewer: 100 kBq/m^3
- Maximum β/γ-activity for disposal at the sewer: 1000 kBq/m^3
- Maximum amount α-activity per year: 20 MBq
- Maximum amount β/γ -activity per year: 200 MBq

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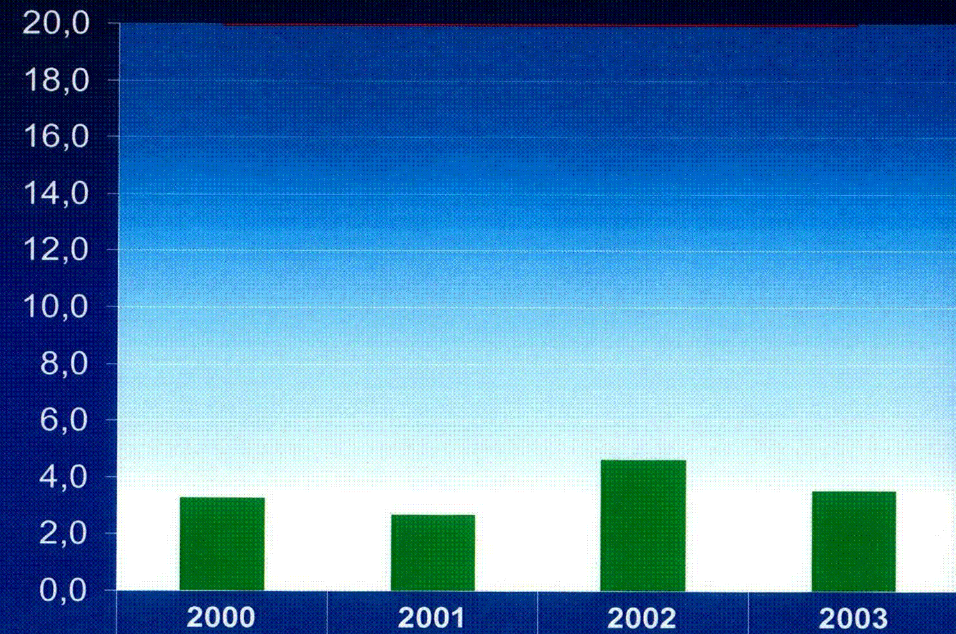
RA emission to the sewer

- In 2003 a total of 370 m^3 aqueous effluent with an α-activity of 3,5 MBq



	2000	2001	2002	2003
alfa activity MBq	3,3	2,7	4,6	3,5
alfa limit	20	20	20	20

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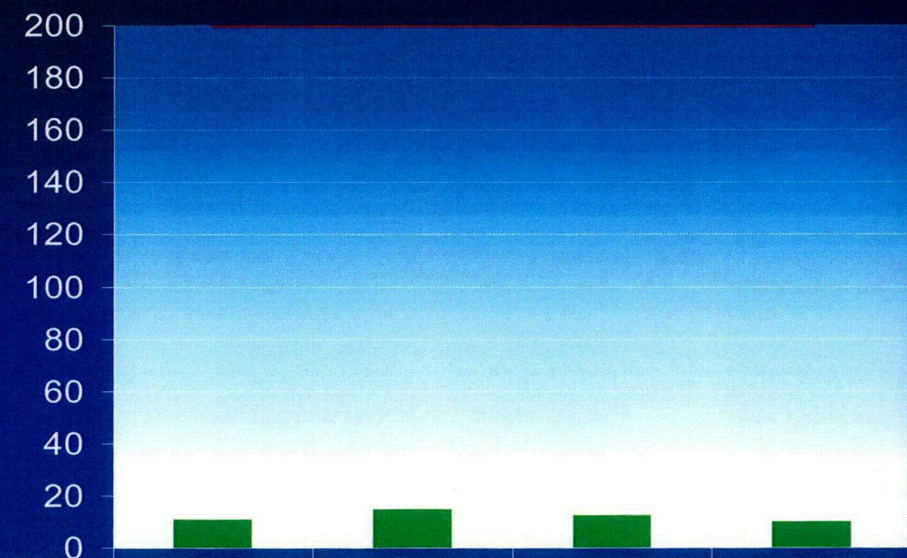
C05

RA emission to the sewer

- In 2003 a total of 370 m^3 aqueous effluent with a β/γ-activity of 10,3 MBq



	2000	2001	2002	2003
bèta/gamma activity MBq	11,2	15,2	12,6	10,3
bèta/gamma limit	200	200	200	200

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C06

Environmental RA measurements

- In order to exclude RA contamination of the environment yearly measurements are performed to determine the uranium concentrations in:
  - ground water
  - surface water
  - sewage sludge

Concluding remarks

- Exposure of personnel and environment is far within the limits imposed by Dutch legislation
- Effluent emissions are continuously analysed and registered
- All environmental measurements are subject to monitoring of the legislator and contra-expertise measurements by RIVM

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Concluding remarks

- Measurements of dose exposure are performed by an independent laboratory and subject to government registration
- The low dose exposure of Urenco NL personnel reflects the commitment to the ALARA principal

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Approach to Criticality in the NEF Project

NRC Visit to Almelo

16/17/18 March 2004

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Contents

1. Principles
2. Safe Geometries
3. 30 inch Product Cylinder
4. Product Vent Subsystem Pump/Trap Sets
5. Product Pumps
6. Citric Decontamination Tank
7. Movement
8. Double Contingency

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1. Principles

Preferred hierarchy of safety design

- Safe geometry
- Passive engineered devices
- Active engineered devices
- Administrative controls

Double contingency principle

- For each and every criticality scenario the double contingency principle is satisfied

Interactions

- Best up to date monte-carlo program used, currently Monk8A

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2. Safe Geometries

Adopted safe geometries at 6 weight % U_{235}

Parameter	**Critical Value**	**Safe Value**
Volume	24l	18l
Cylinder diameter	24.4cm	21.9cm
Slab thickness	11.5cm	9.9cm
Area density	9.5g/cm^2	7.5g/cm^2
Uranium Mass	27kgU	
No double batching		19.5kgU
Double batching		12.2kgU

Safe value figures are at k effective = 0.95

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3. 30 Inch Product Cylinder

Safe by moderation control
Safe by mass control
Safe by enrichment control

Cylinder modelling runs in a mixed array of 48Y and 30B cylinders where the cylinders are not potentially exposed to snow, hail, water sprays or foam or other similar external moderators show the maximum safe amount of hydrogen per cylinder (at k effective <0.95) is

0.95 kg Hydrogen 30B
1.05 kg Hydrogen 48Y

<0.95KgH

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3. 30 Inch Product Cylinder

Hydrogen contributors

190g (heel) + 111g (oil) + 2.3g (water) + 16g (HF) + 18g (air inleakage) + 0.26g (number of vents allowed)

<950g

Number of vents allowed >2000

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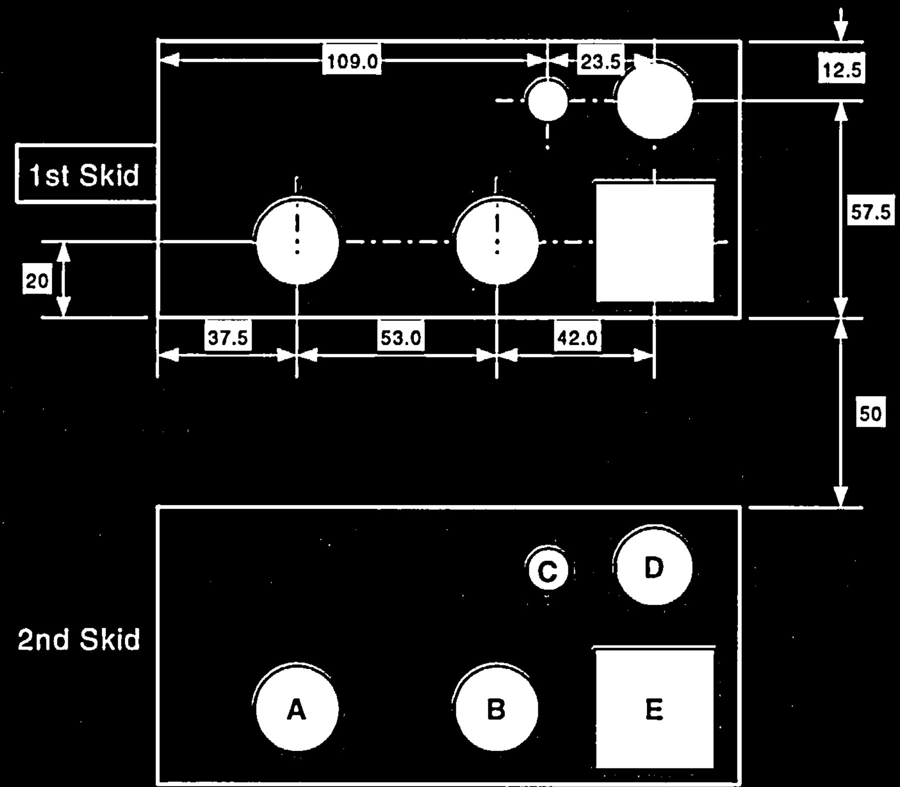
4. Product Vent Subsystem Pump/Trap Sets



A = Charcoal Trap
B = Alumina Trap
(modelled as charcoal)
C = Oil Catchpot

D = Alumina Oil Trap
E = Vacuum Pump
All dimensions are in cm

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4. Product Vent Subsystem Pump/Trap Sets

Safe Geometry

Individual components;

- Have safe geometry
- Chemical trap internal diameter 20.3cm
- Pump volume 14l
- Catchpots (a few litres)

Static interactions;

- Interaction of fixed
- Geometry components is modelled

Movement interaction;

- Interaction of vessels in
- Movement is modelled

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5. Product Pumps

Product pump set comprises two pumps set in a frame.

Internal pump volumes are 8.52l and 33l.

Where a component is greater than safe volume manufacturers drawing is used in the modelling and the pump set combination is modelled.

In this case a k effective of 0.74 79 was achieved for the fixed interacting pumps assuming the pump volumes were full of 6 weight % moderated Uranyl Fluoride.

Movement interaction was modelled in this case achieving a k effective of 0.8743.

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6. Citric Decontamination Tank

Each tank with unfavourable geometry is safe only by mass and enrichment control.

Enrichment control is not tank specific and is dealt with at the cascade

Non favourable geometry tanks are therefore safe only by Uranium mass control

Each tank has two routinely taken mass measurements

- Measurement 1 is derived from a routinely taken representative tank liquor sample analysed for gU/l and the volume of liquor.
- Measurement 2 is the running mass balance

These measures are supplemented by;

Allowable mass in any tank is within double batch safe value

Each tank is regularly emptied, cleaned out and internally inspected

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6. Citric Decontamination Tank

Uranium Mass

Tank is 800l capacity

Typical dimensions 1.33 x 0.95 x 0.80 m

Citric maintained at 5-7% concentration

Concentration controlled to 0.2gU235 per l

Equivalent to 3.33gU per l at 6% enrichment

Equivalent to 2.42kgU at 6% enrichment

(compared with safe value of 12.2KgU with double batching allowance)

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6. Citric Decontamination Tank

Controls

- Visual inspection of components inputs to confirm minimal U inventory and product pump batch limit
- Concentration sampling program and action limit
- Mass balance program
- Mass limit well within double batching allowance
- Visual inspection of tank after each emptying to confirm no retained sludge
- Criticality training program

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7. Movement

Movement rules

- Movement of plant components, which contain enriched Uranium from their fixed plant positions are subject to controls.
- Such controls are, where possible, expressed in a standard way i.e.
  - Where a component (e.g. a low pressure product pump) is being moved from its fixed position it may touch another installed product pump without restriction.
  - Additionally a standardised vacuum cleaner may approach the touching pair without restriction.
  - Additionally only one other component may be in transit within the plant at any one time and may not approach within 60cm of the product pumps.
- Each case is specifically modelled to confirm satisfactory k effective.

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7. Movement

Controls

- Administrative procedures
- Passive engineered separation devices
- Criticality training program

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8. Double Contingency

Criticality Scenario	Contingency 1	Contingency 2
Pump movement criticality	Air inleakage	Administrative or engineered controls failure
Product cylinder fitted to feed leading to over enrichment criticality	Incorrect cylinder	Passive engineered failure device
Criticality in cylinder in product take off stations due to loss of moderator control	Air inleakage	Vent count error
Criticality in GEVS filter due to failure in product vent system	Vent system valve failure	Carbon trap weight trip failure
Criticality in GEVS due to product material in autoclave	Loss of primary containment	HF shot bolt failure

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Water Consumption

- 2003 extreme warm Summer
- During the Year 5 New Cascades online
- SP5 Cooling Tower per Cascade
- Special Design with Reheat Coil
- 91% Water Consumption in SP5 is Cooling Towers

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Water Consumption

Date	Capacity
1-1-2003	544 tSwu/a
1-2-2003	612 tSwu/a
1-4-2003	680 tSwu/a
1-6-2003	748 tSwu/a
1-9-2003	816 tSwu/a
1-11-2003	884 tSwu/a

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Water Consumption

- Average Consumption 1589 M^3/tSwu Month
- Based on 3000 tSwu/a, Consumption is 15 Million Gallon/a

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Water Consumption

Improvements:

- Other Design of Spray Water, less Water to the Sewer
- Using new Design Cooling Tower, based on SP5 Design , Wet and Dry Section

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