Progress with Licence Termination (Delicensing) of the UKAEA, Harwell Site, UK

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Harwell

- Near Didcot, Oxfordshire
- Former RAF airfield
- Original licensed site - 113 hectares
- Part of the Harwell Science and Innovation Campus
- Site of early nuclear research laboratories and reactors
- Research reactors GLEEP, BEP0, Dido and Pluto

Delicensing at Harwell

- End state for Harwell is for a fully delicensed site
- For most areas of the site delicensing logically follows on after decommissioning of the facilities
- Phased approach to delicensing to gain experience and competence
  - ETSU Area, 5 hectares, delicensed 1992
  - Pilot Area, 7 hectares, delicensed 2006
  - North Gate Area, 5 hectares, case submitted
  - Eastern Area Facilities, 5 hectares, case submitted

Harwell Site Delicensing (2006 – 202?)

Delicensing Process - What's involved?

- Historical survey of records and maps/drawings
- Radiological and chemical surveys of the land
- Building/drains surveys
- Investigation/remediation of anomalies
- Prepare Delicensing Case
- Formal Submission to Nuclear Installations Inspectorate (NII)
- NII verification surveys
- Clarifications/discussions
- NII Approval
- Mark the new boundary
- Issue of Licence Variation

Delicensing Criteria

HSE Issued Delicensing Policy issued in May 2005

- Additional risk of death to the individual meets a risk criteria of 10^{-6} /y for any foreseeable use (equivalent to 10-20 μ Sv/y)
- No radioactive waste left on site

Meeting the Risk Criteria in HSE Policy

The risk criteria given in the HSE Delicensing Policy can be met by either :

- Demonstrating that residual, isotope specific, activity levels are below levels set in **IAEA Safety Standard Series No.RS-G-1.7**, 'Applications of the Concepts of Exclusion, Exemption and Clearance, or
- Carrying out a **site specific risk assessment** to demonstrate the risk level is met

IAEA Guideline Values

www-pub.iaea.org/MTCD/publications/PDF/Pub1202_web.pdf

- Gives Bq/g clearance levels for a list of radionuclides

Radionuclide	Clearance level, Bq/g
Cs-137	0.1
Co-60	0.1
Pu-239	0.1
Pu-241	10
Am-241	0.1
H-3	100
Sr-90	1

What's in a Delicensing Case?

- History of land, buildings and facilities.
- Identification of new site boundary.
- Control of access to the remaining licensed site.
- Delicensing criteria and clearance levels.
- Demonstrating the clearance levels have been achieved.
- Effect on safety cases for facilities on remaining licensed site.
- Location and integrity of active drains.
- Off-site environmental monitoring arrangements.
- Transport of radioactive material across the delicensed site.
- Emergency arrangements for the delicensed site.

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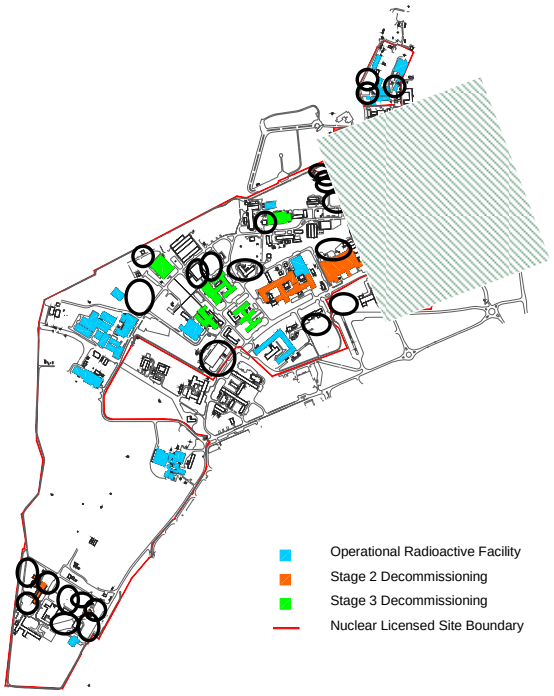
Generic Sampling And Surveying Programme

- Most areas & buildings have a history of previous surveys to build upon – we have already got to the point we are convinced the area is clean.
- Pre demolition health physics surveys of all buildings
- Concrete sampling from structures remaining
- Samples collected on 10m grid under building footprints (25 m grid elsewhere)
- Plus extensive targeted sampling and investigation based on historical research
- All samples analysed by gamma spectrometry and gross alpha/beta analysis
- Selected isotopic analysis
- Gamma survey of excavated surface where possible
- Trial pitting over whole site
- Final Gamma survey after site reinstatement
- Dose rate measurement grid

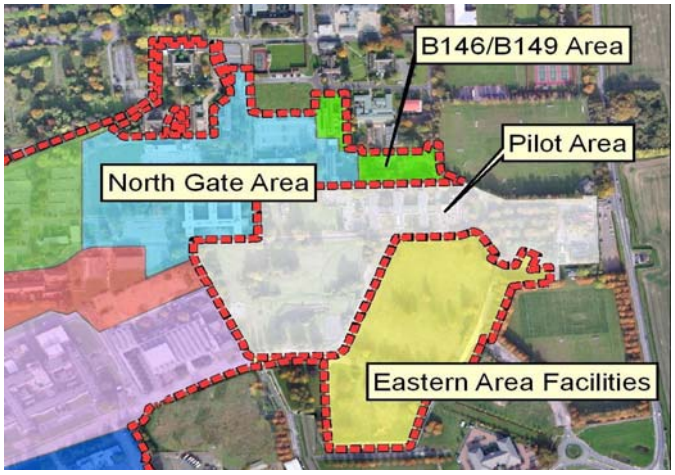
Harwell in Yr 2000

140,000 m^2 of building footprint removed

40 nuclear facilities fully removed



Delicensing Areas



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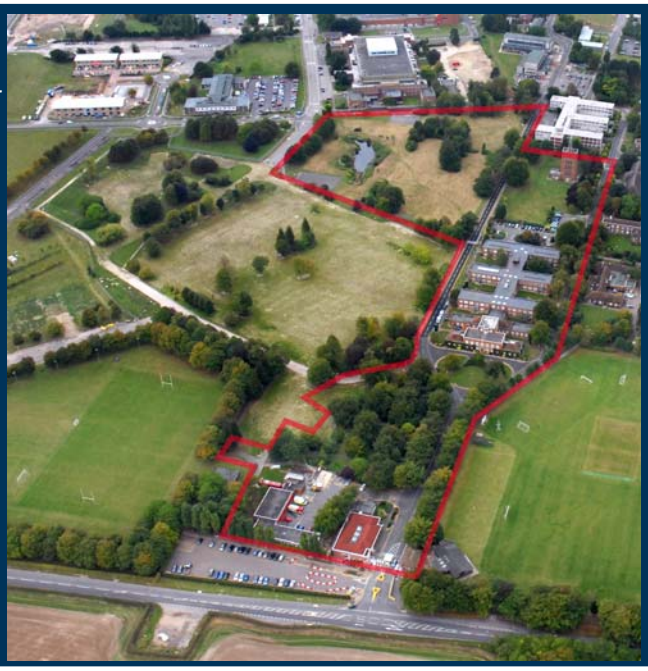
Pilot Area



The Pilot Zone

- 70,000 m^2
- 43 buildings existed
- 6 buildings remain
- Trade Waste Drain
- 10 buildings with radiological history

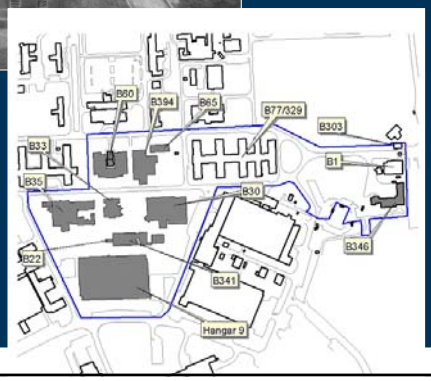
Active Workshops

Fabrication

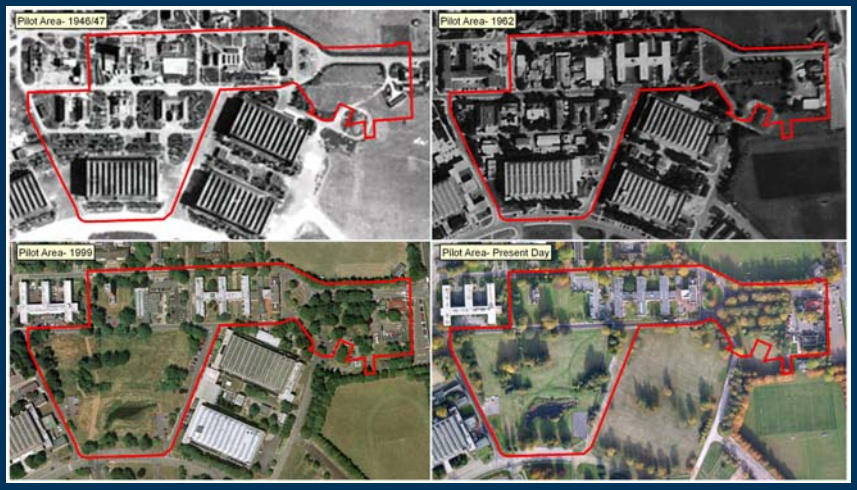
Liquid Waste Stores

Uranium Workshops

Fire Station



History of the Pilot Area

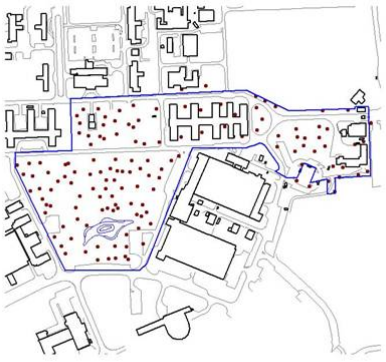


Pilot Area Surveys

- Building surveys
  - Alpha, beta and gamma surveys of all buildin including roofs
  - Intrusive investigations of radiation anomalie
- Land surveys
  - Gamma survey of all open land
  - Alpha and beta surveys of selected areas
  - Dose rate survey
  - Intrusive surveys on a 23 m grid 3 m depth.
  - 500 samples for analysis
- Drains….

Land Sample Locations

- Samples taken on 23m grid
- Sampled at 3 depths down to 3m
- Chemical and radiochemical analysis



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Pilot Area
Buildings
Current
Lagoons
Depth 0m to 0.2m
Roads

Geophysical Data

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Gamma Survey

260,000 survey points recorded

The Eastern Area – Before Decommissioning

EAF

- 5.05 hectares
- Four major buildings existed
  - Hangar 7
  - Hangar 8
  - B477 (Tandem Generator)
  - B3
- 33 buildings existed
- 9 buildings with history of handling radioactive material
- All buildings demolished 2005
- Underground concrete structures remain

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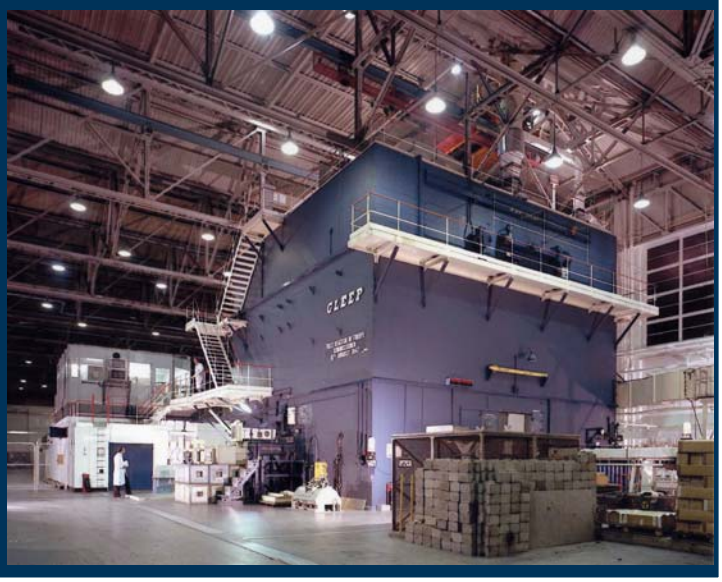
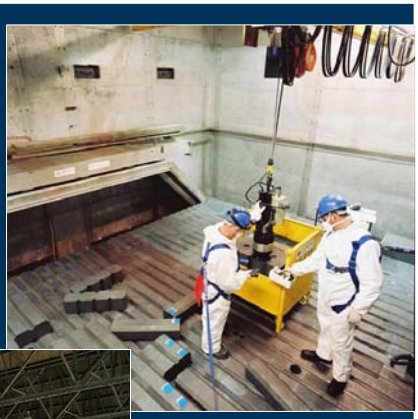
GLEEP Reactor



GLEEP Decommissioning

- Built mid-1940's, operated Aug 1947 to Sept 1990
- Thermal heterogeneous reactor, graphite moderated/reflected, air cooled, natural Uranium metal fuel.



Controlled Explosive Demolition of the Tandem Van De Graaf Generator

Sampling During Demolition

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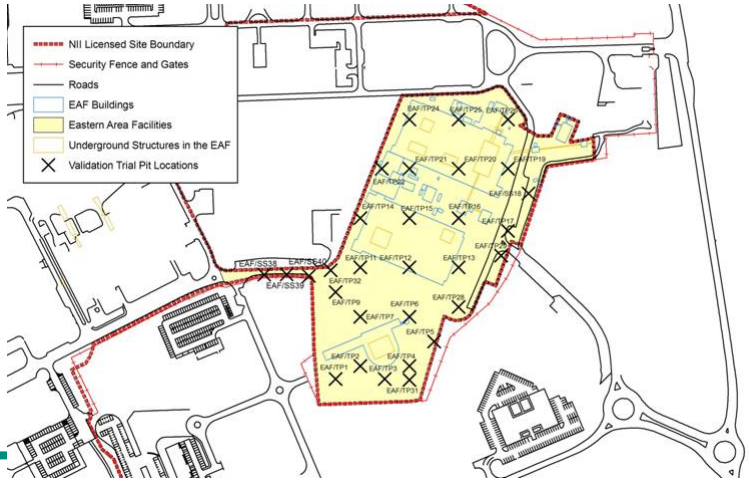
Post Demolition Trial Pit Locations



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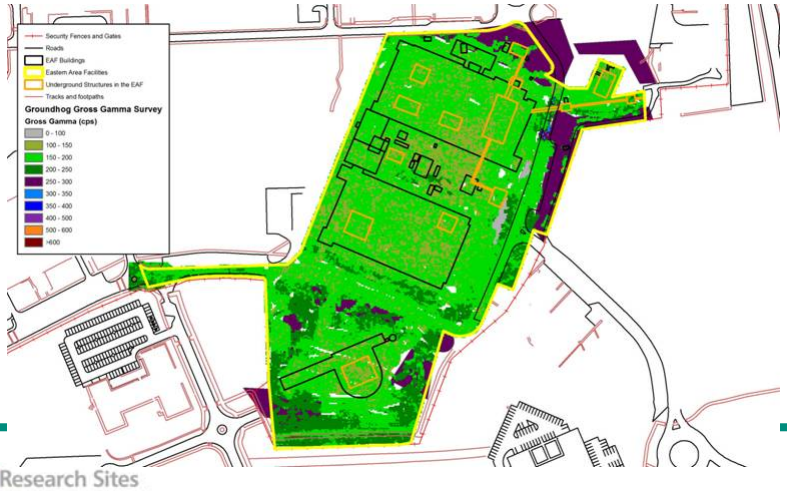
Final Groundhog Survey



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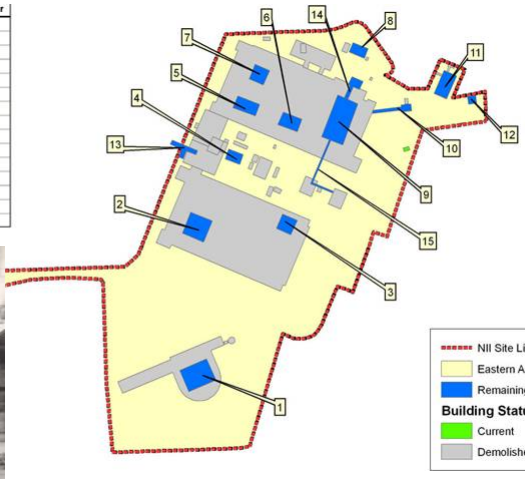
Concrete Foundations Remaining

Name	Number
B477 Basement	1
Hangar 8 Van De Graaff	2
GLEEP	3
B8.6 Delay Tank	4
Small Cyclotron	5
EMS	6
ZETA	7
B7.10 Delay Tank (Target Room C)	8
Synchrocyclotron/Van De Graaff	9
Flight Tube and Target Room A	10
B3	11
Target Room B	12
Hangar 7 & B8.9 Service Duct	13
North Flight Tube Remains	14
Service Duct	15



Activation Activities in Cyclotron Pit Concrete

	Gamma	H-3	Fe-55	Total
	Bq/g			
West Wall				
Average	0.06	0.3	0.1	0.35
Maximum	0.48	3.7	0.16	4.34
Mezzanine Floor				
Average	0.12	0.6	0.02	0.74
Maximum	0.77	4.1	0.16	5.03

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HPA Risk Assessment

- **Scenario** **Estimated Dose (Sv/y)**
- *Leaving concrete in-situ*
- **Site development - Construction worker** **$7.9\ 10^{-15}$**
- **Site use - office worker** **$2.7\ 10^{-15}$**
- **Site use - car park user** **$8.9\ 10^{-17}$**
- **Site use – paved area** **$7.2\ 10^{-15}$**
- **Drinking water consumption** **$6.2\ 10^{-6}$**
- *Removing and reusing the concrete*
- **Removal of the concrete – worker** **$5.0\ 10^{-6}$**
- **Processing of removed concrete - worker** **$5.1\ 10^{-7}$**
- **Reuse of removed concrete - pavement user** **$1.1\ 10^{-7}$**

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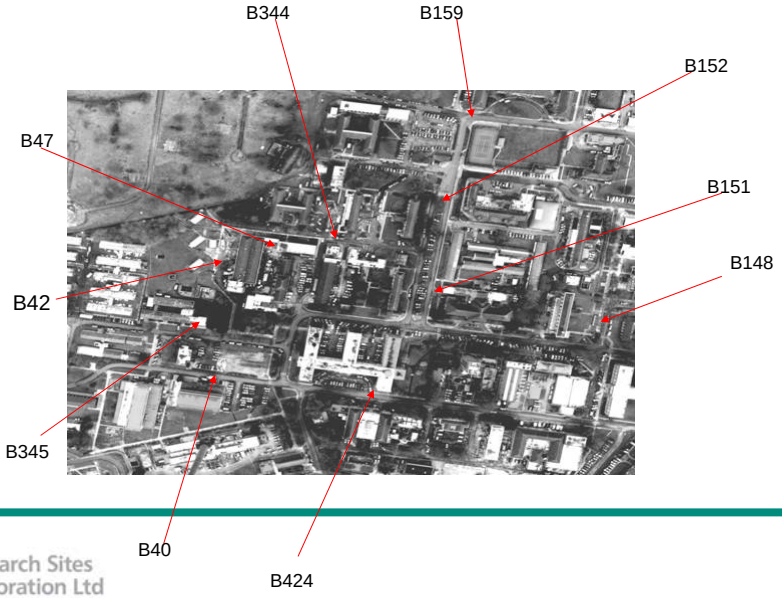
The Eastern Area – After Decommissioning

Aerial View of North Gate Area March 1992



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OMAD Removal

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Trade Waste Drains

- TWD on Harwell site is being decommissioned
  - Pressure washed
  - CCTV inspected
  - Faults and unknown sections to be removed
  - Gamma survey
  - grouted
- All drain sections exceeding delicensing criteria will be removed

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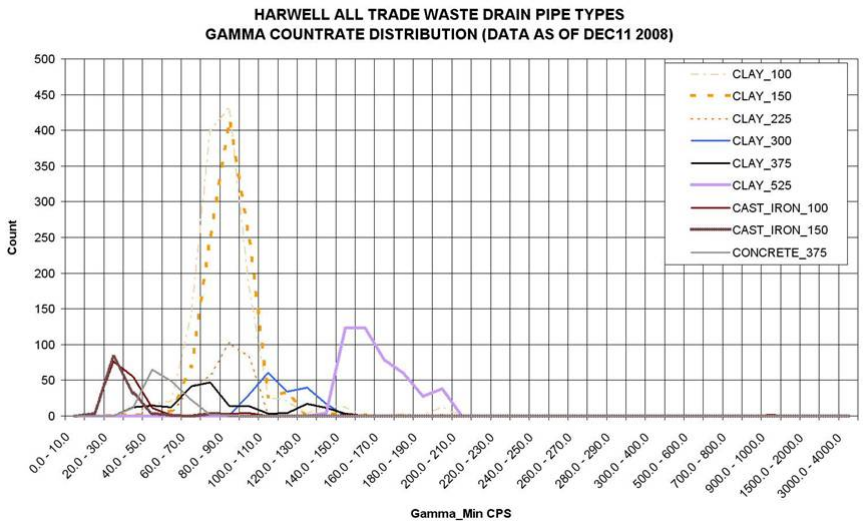
Gamma Survey Distribution



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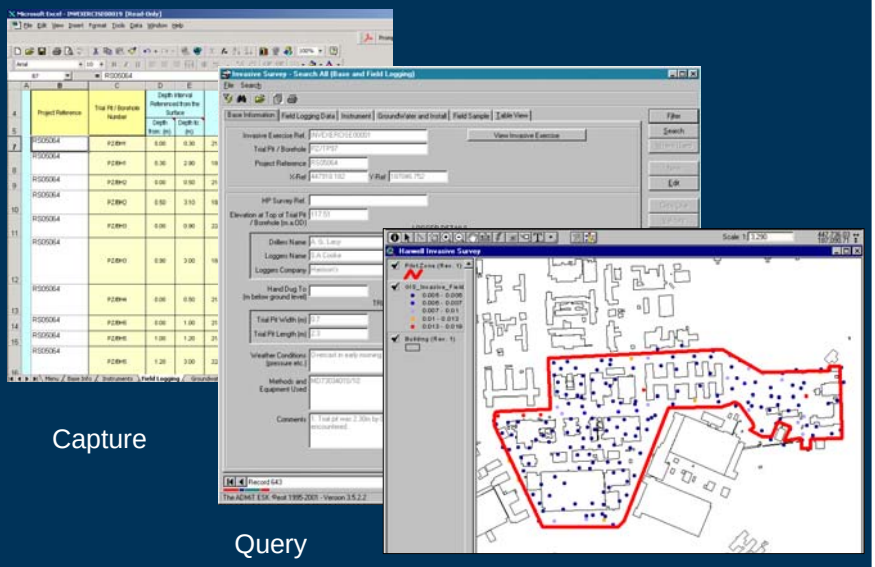
Key Issue - Records

- A good records management system is essential
- Accurate and reliable records make delicensing easier
- Delicensing may take place years after decommissioning works – can't rely on memories
- Ensure comprehensive Post Decommissioning Reports are produced
- Involve delicensing team in planning decommissioning and demolition planning

Geographical Information System



Capture

Query

Analysis

Lessons Learned

- Providing confidence is as important as the numbers
- Demonstrating negatives is often necessary ie a section of drain isn't there any more
- Attention to detail
- Build delicensing requirements into decommissioning and land remediation works
- Keep good decommissioning/remediation records
- Work with the NII as far as possible
- It takes time to delicense!

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