

Decommissioning, Deactivation, Decontamination, Demolition (D4)

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PRESENTATION



Worley
energy | chemicals | resources

The logo for Worley, featuring the word "Worley" in a bold, blue, sans-serif font. The letter "o" is stylized with a red and blue gradient. Below the main name, the words "energy | chemicals | resources" are written in a smaller, blue, sans-serif font, separated by vertical bars.

What is D4?



▶ Decommissioning

- Pre-defined operation to leave site systems and equipment in optimal condition for deactivation phase.



▶ Deactivation

- Moving a facility from an operating or operable state to a condition ready for demolition e.g. draining systems, isolating energy sources, inserting blank flanges.



▶ Decontamination

- Removal of product or materials (including hazardous) to allow safe demolition and cost effective materials management of the resultant scrap.



▶ Demolition

- Activities required to dismantle or demolish equipment, structures or foundations to the agreed level.
- Removal of all saleable equipment and materials.



▶ Extraction & Processing

- Extraction is defined as removing materials to a suitable location for processing activities to proceed.
- Processing is defined as refining the end state of that material to the agreed marketable quality for sale or disposal.



▶ Site Restoration

- Site remediation, monitoring, site divestiture to the agreed end state.

Decommissioning

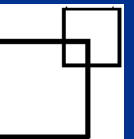
Considerations

Feasibility Study

- Decommissioning and Remediation Objectives
- Regulatory Requirements
- Engineering Studies
- Health and Safety Risk Assessments
- Environmental Risk Assessments
- Financial Risk Assessment

Engineering Studies

- Earthworks/Civil
- Process Plant
- Hazardous Waste minimisation
- Demolition risk Analysis
- SIMOPS Analysis



Deactivation

Considerations

Site Preparation

- Environmental Survey
 - Benchmarking Soil, Water, Asbestos, Lead based paint, heavy metals and other hazardous materials
- Development of conceptual site models identifying pollutant linkages
- Understand Contaminated site obligations
- HAZMAT Assessment
- Isolation and Disconnection plan
 - Draining
 - Venting
 - Battery limit requirements
 - Air gaps

Regulatory Approvals

- Defining Closure Criteria
- Regulatory requirements
 - Local council agreements
 - Lease conditions
 - Environmental approvals conditions
 - Environmental management plans
 - Closure plans
 - Local Iwi consultation
 - Stakeholder consultation
 - Remediation plans



Decontamination

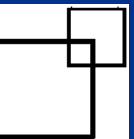
Considerations

Equipment Preparation

- Cleaning requirements
 - Water flushing
 - Steaming
 - Chemical cleaning
 - Venting

Waste Management

- PPE requirements for handling Hazardous materials and waste
- Understand Contaminated site obligations
- Identify Hazardous waste disposal facilities
- Identify on-site waste disposal opportunities
- Material / Equipment resale and recycling assessment
- Provisions for Occupational health monitoring.



Demolition

Considerations

Demolition Resources

- Selection of Demolition contractor
 - Review of Safety Statistics
 - Safety systems
 - Experience
 - Resource availability
 - Equipment spread
 - Methodology
 - Risk Assessment
 - Lifting Plans
 - Site management processes
 - Environmental management plan
 - Engineering review process



Extraction and Processing

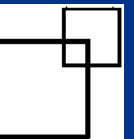
Considerations

Extraction Process

- Material identification
- Control of Hazardous materials
- Identify extraction Laydown areas
- Waste management plan developed for all laydown areas
- Waste stream separation

Processing

- Waste stream analysis
- Processed waste separation
- Weight and measurement facilities
- Sales Analysis
- Scrap marketing process



Site Restoration

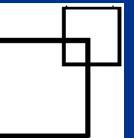
Considerations

Site Handover

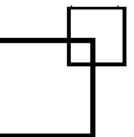
- Detailed Site investigation
 - Deconstructed Site footprint Modelling
 - Post demolition environmental survey
 - Evaluation against pre start survey baseline

Site Remediation

- Implementation of the Remediation Action Plan
- Validation of End State Analysis
- Consents for change of use
- Development of ongoing monitoring program – if required.
- Weight and measurement facilities
- Sales Analysis
- Scrap marketing process



The Closure Process



Common D4 Risks & Mitigations

Risk	Mitigation
Lack of definition of required facility end-state	<ul style="list-style-type: none"> ▪ Early and clear definition of required site end-state and intended future use.
Decision inertia	<ul style="list-style-type: none"> ▪ Failure to make early decisions relating to the project can impact on overall closure schedule massively. Define project critical decision gates early.
Interface with live plant	<ul style="list-style-type: none"> ▪ Detailed deconstruction/demolition sequencing to eliminate potential risk to live plant. ▪ Clear operational and physical demarcation of construction zone.
Presence of hazardous materials	<ul style="list-style-type: none"> ▪ Detailed inventory completed in planning phase, procedures in place for on-site removal, handling and waste management processes.
HSE during demolition (working at heights, lifting, dust, vibration)	<ul style="list-style-type: none"> ▪ Detailed HSE plan, demolition methodology, lift plans, identification of hazardous materials, environmental survey, workplace health and safety monitoring.

Scrap market fluctuations	<ul style="list-style-type: none"> ▪ Potential to share risk/reward with contractor and potential hedging strategies (forex, commodity, eg iron ore).
Contracting models	<ul style="list-style-type: none"> ▪ Market assessment of materials sales and scrap metal market. Contractor engagement, lump-sum, unit rate, risk-reward.
Shared services	<ul style="list-style-type: none"> ▪ Early identification of shared services requiring retention/modification and detailed planning of required isolations, diversions and/or re-routes.
Regulatory & permitting approvals issues causing late change & delay	<ul style="list-style-type: none"> ▪ Clearly understand regulatory requirements and approval timeframes.
Public relations & stakeholder issues causing late change & delay	<ul style="list-style-type: none"> ▪ Early engagement of project stakeholders (internal & external).

QA

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