



The Lisheen Mine - Discovery to Closure

IMQS Presentation

February 2015

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Lisheen Mine

- Lisheen Mine – Sesa Sterlite - Vedanta Resources
- Discovery and Development
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- Safety Overview
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- People and Closure
- Site Closure, Rehabilitation and Options

Lisheen – Sesa Sterlite - Vedanta

- Lisheen is a mining/mineral processing company wholly owned by **Sesa Sterlite**, a **Vedanta Group** company, now named **Vedanta Limited**
- Vedanta Limited is a London Stock Exchange listed, globally diversified natural resources major with interests in Zinc, Lead, Silver, Copper, Iron Ore, Aluminium, Power and Oil & Gas.
- Vedanta has mining operations in India, Africa, Australia and Ireland, with a strong organic growth pipeline of projects
- Vedanta is committed to international standards for safety and sustainable development and works with stakeholders and local communities
- Lisheen Mine extracts zinc and lead ore from underground, processes this into zinc and lead concentrates and sells these concentrates to smelters and customers in Europe, North Africa and the USA.

Discovery & Development

- 1984: Chevron commence exploration in Ireland
- 1986: Galmoy discovered
- 1987: Chevron starts prospecting around Galmoy
- 1990: Chevron signs Joint Venture (JV) with Ivernia West
- 1990: JV discovers soil anomalies
- 1990: LK-3262 intersects two massive sulphide zones
- 1993: Anglo American takes over Chevron's JV share
- 1997: Construction starts
- 1999: Start of production
- 2003: Anglo American buys out Ivernia
- 2010: Anglo American sells Lisheen to Vedanta for \$308m
- 2015 (Oct): Planned cessation of mining due to depletion of resources
- 2016 (Feb): Completion of Backfilling and closure of mine

Lisheen Mine – Aerial View



Lisheen General Information

- We are located in Tipperary between Thurles, Urlingford and Templemore
- We mine approximately 1.5Mt of ore annually and process in the concentrator onsite
- The average grade of the ore body is 10.9% Zinc (Zn) and 1.8% Lead (Pb)
- The concentrator recovers 90% of the Zn and 70% of the Pb
- The concentrator produces approximately 317Kt of Zn and 39Kt of Pb concentrates annually (Zn 53%, Pb 62%)
- The metal concentrate is transported to the Port of Cork where it is sold to smelters around the world
- 374 people employed plus 26 permanent contractors
- 65% of our employees belong to trade unions (SIPTU 50% and TEEU 15%)
 - There have been no industrial disputes since the mine start-up
- Mine scheduled to close in October 2015, due to depletion of ore reserve

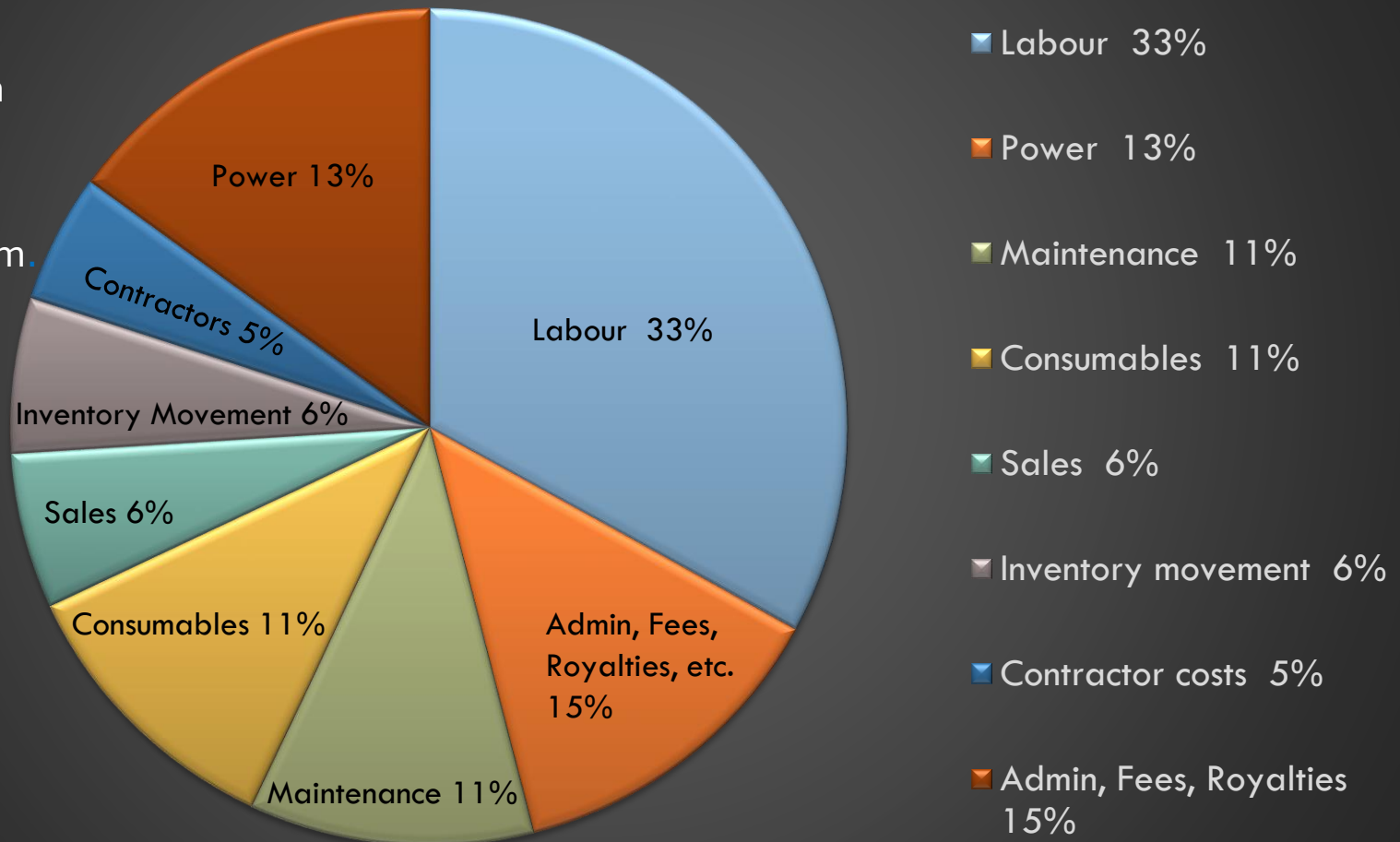
Lisheen General Information

- We are one of the largest power consumers in Ireland, predominantly due to the large volumes of underground dewatering and the requirement to mill the ore material so finely
- Power costs constitute a sizeable portion of the operating costs (€10M + per annum)
- **ISO 14 001** (environmental systems) accredited (NSAI) (since 2002)
- **OHSAS 18 001** (occupational health and safety systems) accredited (NSAI) (since 2005)
- **Excellence Through People (NSAI)** – Ireland’s Human Resources and Training standard. Lisheen Mine holds **Gold Standard** accreditation.
- Operate under an **Integrated Pollution Control Licence (IPCL)** from the EPA (noise, vibration, air emissions, water discharges, etc.).

Lisheen General Information

Lisheen Budget €110 Million

Smelter and treatment charges are deducted from revenue and amount to approximately €5M per annum.



Safety Overview



NOTHING....

Stephen Chester

**Not Production, Not Profit, Not Sales, Not
Anything....**

run the mine

COMES BEFORE SAFETY

Kevin Nolan

Brandan Morris

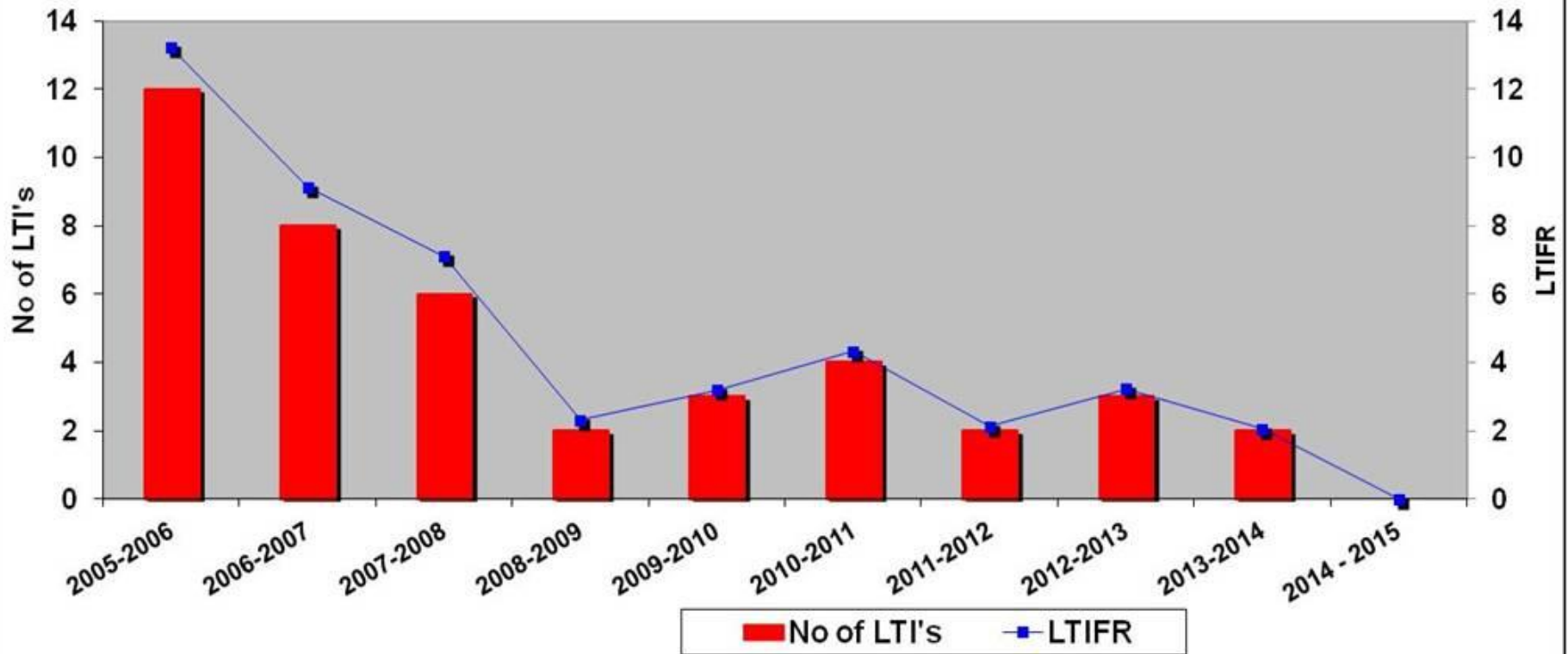


Al D. Kelly
Si D...



Safety Overview

Lost Time Injury Frequency Rate History & YTD



In order to achieve the reduction in LTIs, many safety initiatives were undertaken

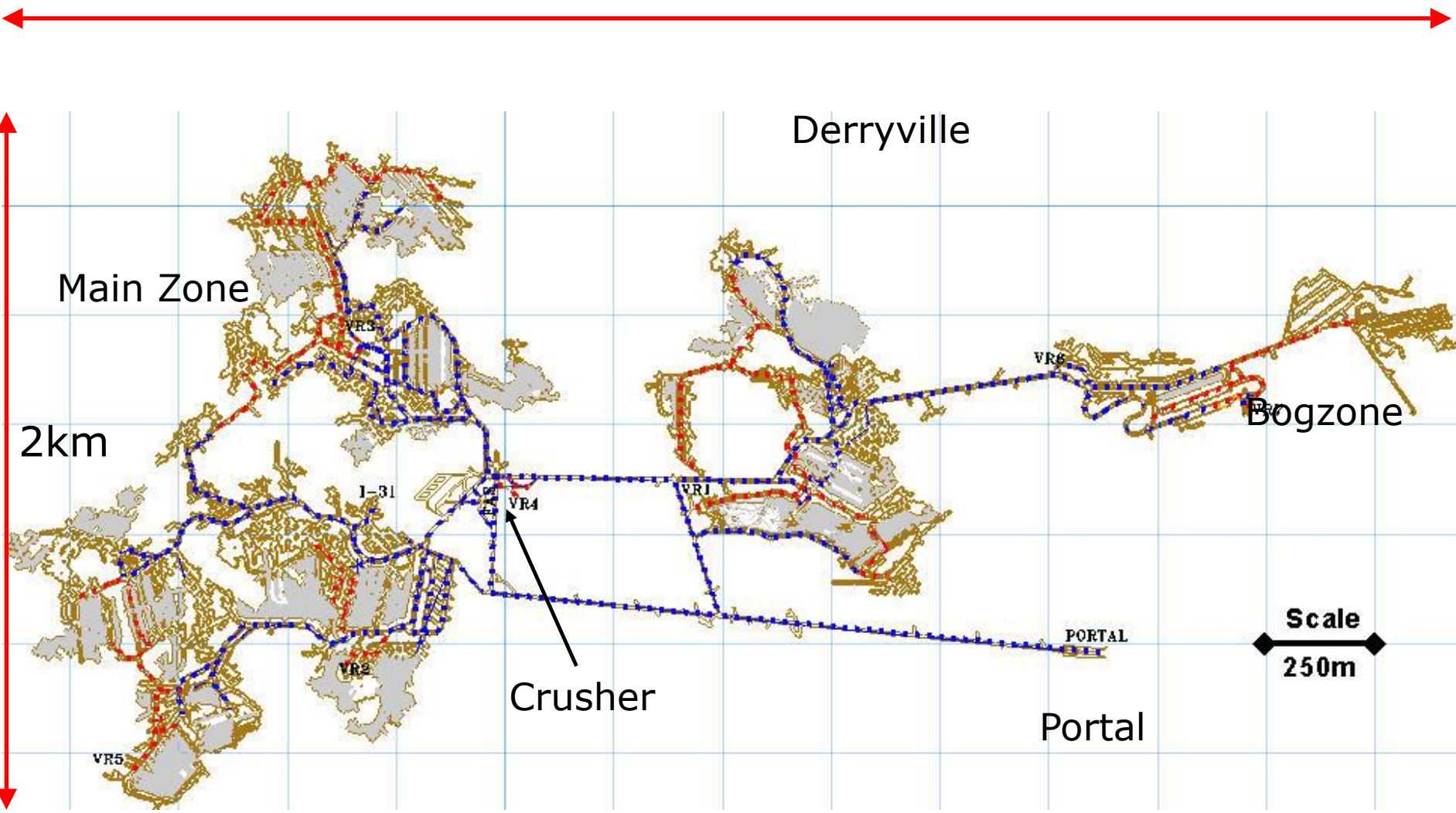
- Safety campaigns for specific topics (e.g. manual handling, PPE, ground control awareness)
- Improved communication regarding all aspects of safety
- Investigation analysis improved to minimise repeats
- Increased safety visits to ensure compliance

The Mining Process



Lisheen Mine – Plan View

4km



Underground - General Information

- 5,000 tonnes of ore mined and crushed per day
- Ore hoisted via conveyor system from crusher to tepee on surface
- Mining takes place 6 days per week
- Ventilation required is $500\text{m}^3/\text{sec}$, via 5 intake airways and 6 exhaust airways
- Mobile equipment maintenance carried out in modern underground workshop



Underground Portal



- 1.7km long decline, 7m X 4.5m, -15°
- Suspended hanging wall conveyor (1.5 km long, 1.0m wide)
- Conveyor System 2.4m/s, 420 tph from crusher
- Primary intake airway
- Three secondary egresses via Alimak raise climbers

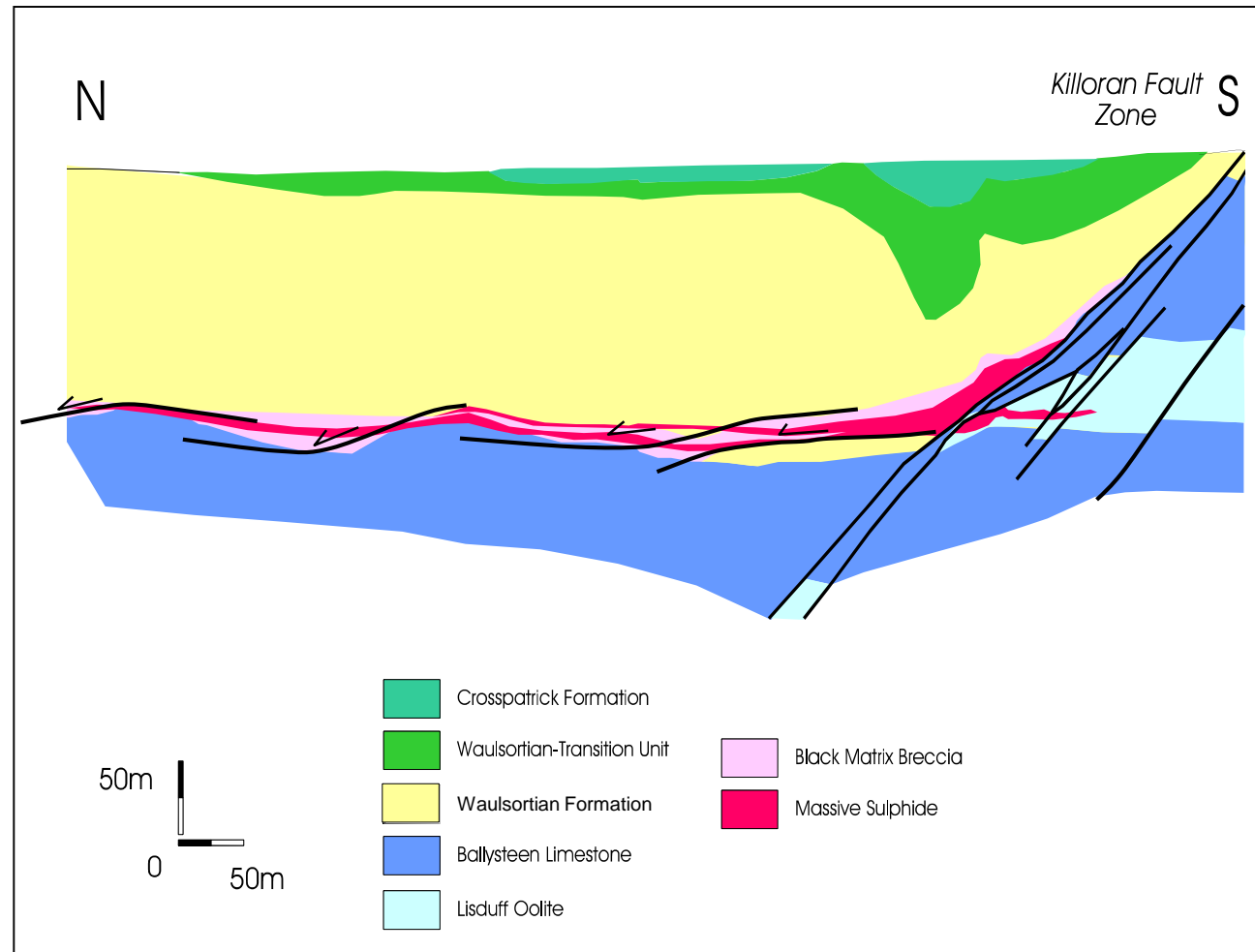


Underground - Geology

- Structurally-controlled, carbonate-hosted, stratabound, massive and disseminated sulphides

- Complex geometry and grade variability requires close-spaced drilling combined with significant grade control and mine geology effort to define the orebody adequately for productive mining

- Strong and well understood geological controls restrict the extent of mineralisation and therefore the possibility of significant upside extension



Underground - Water

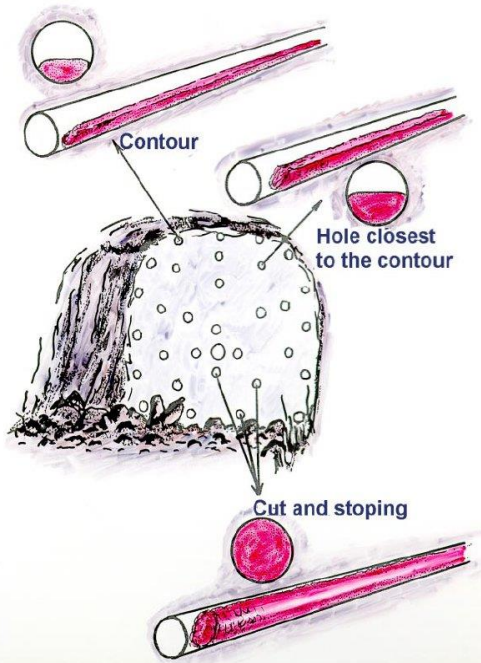


- 70-100 million litres pumped from underground every day
- Water is classified as either 'clean' or 'dirty'

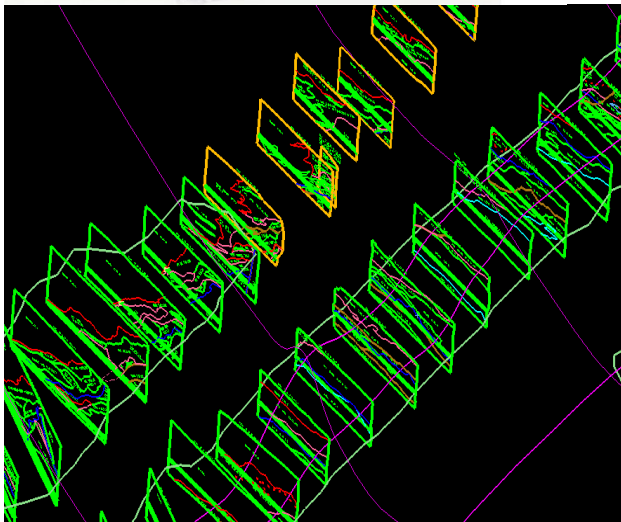
- Dirty water is treated on surface, then diluted with clean water and pumped into local rivers in compliance with EPA licence



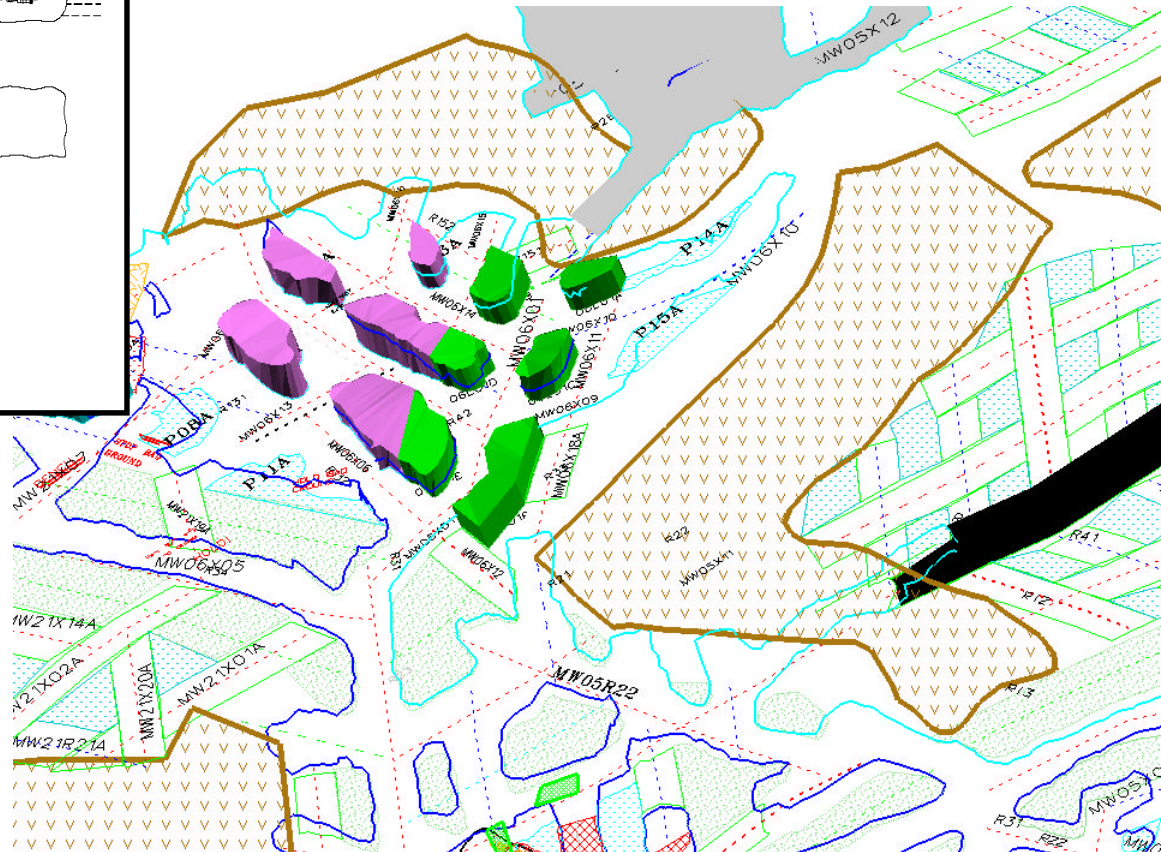
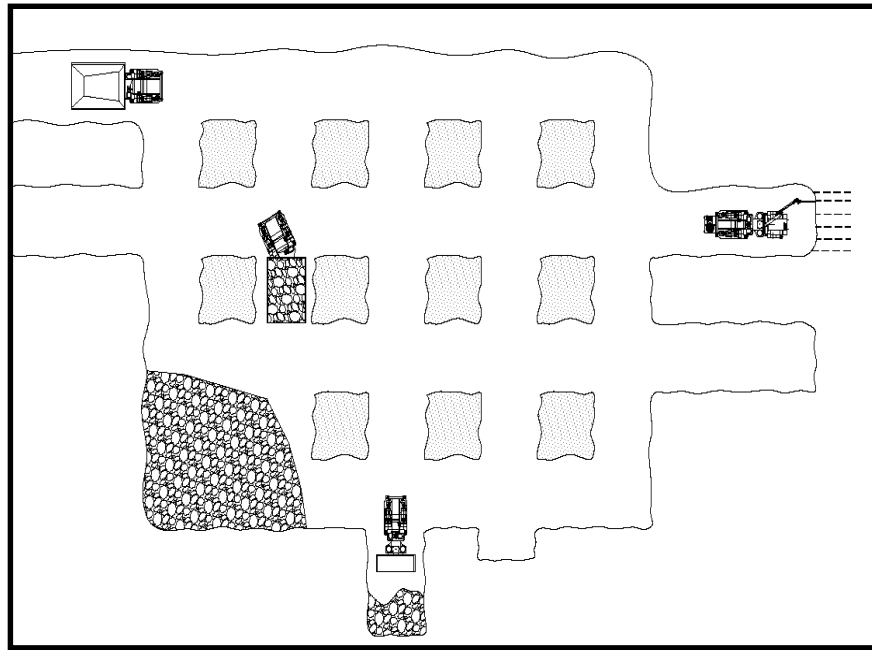
Underground - Development Mining



- Drill Length 3.9m
- Standard Round 4.5m wide x 6.0m high
- No. Holes 64
- Quantity of explosives 267kg/round
- Explosives Site sensitised emulsion
- Ore round yield 350 tonnes
- Waste round yield 250 tonnes
- All faces are contour charged to avoid overbreak in roof
- All faces bolted on 1.5m x 1.5m pattern
- All faces are geology mapped

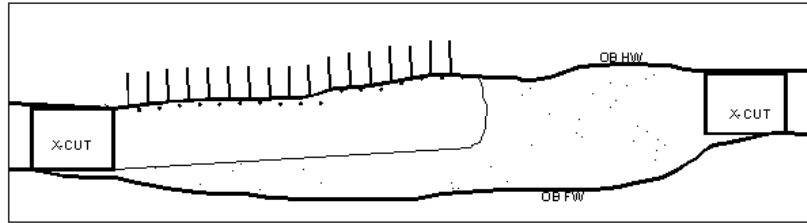


Underground - Room and Pillar Mining

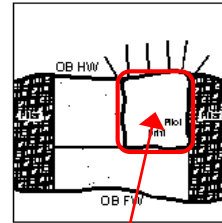


Underground - Drift and Fill Mining

1st. PASS MINING (Phase 1)

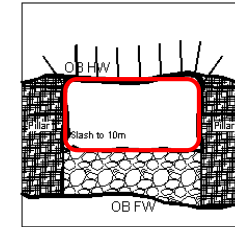


Support Provided
Roofbolts 2.4m Long @ 1.5m c/c



Support Provided

Roofbolts 2.4m Long @ 1.5m c/c.
Sidewall-bolts 2.4m Long @ 2.0m c/c.
Shotcrete Back and Sidewall.



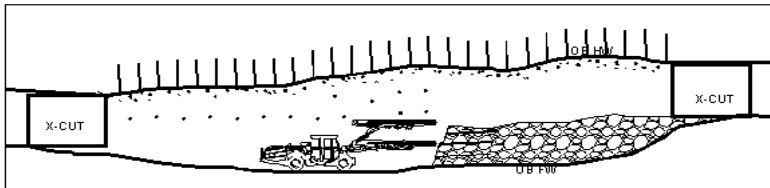
Phase 1 - Drift and Fill First Pass Mining - 5m(w) x 4.5m(h)

Phase 2 - Slash to 10m

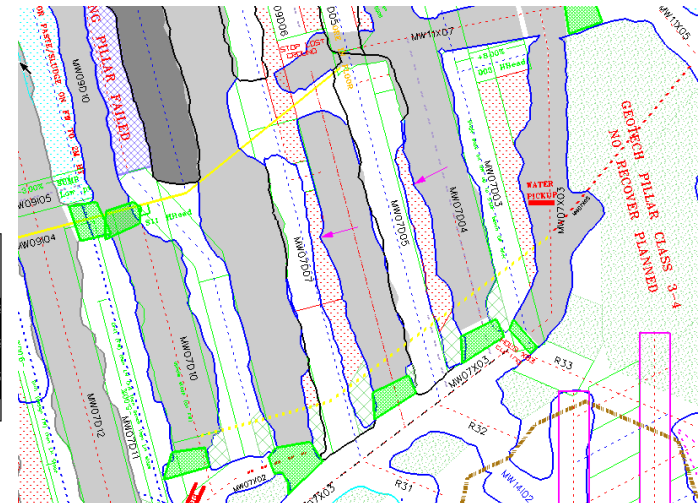
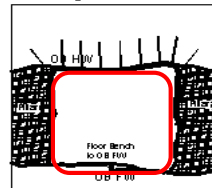
Phase 3 - Install sidewall bolts and shotcrete on roof/sidewall

Phase 4- Second Pass Mining

2nd. PASS MINING (Phase 1)

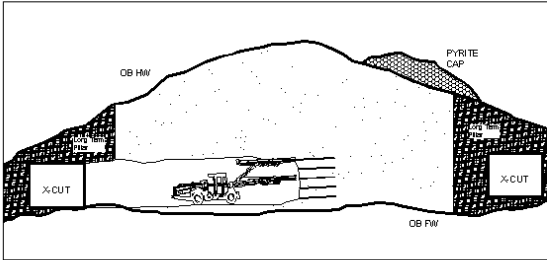


Support Provided
Roofbolts 2.4m Long @ 1.5m c/c.
Shotcrete Back and Sidewall.
Sidewall-bolts @ 2m c/c.

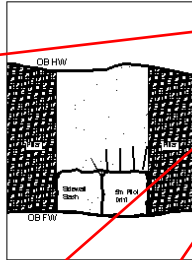


Underground - Longhole Open Stopping

Stope Development



Support Structure
Height is 2.4m long @ 1.0m cut



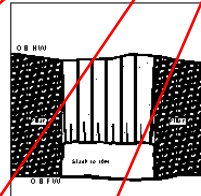
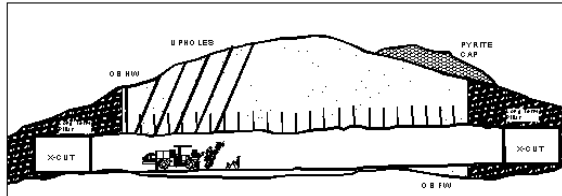
Phase 1 – Development

Phase 2 – Production Drilling

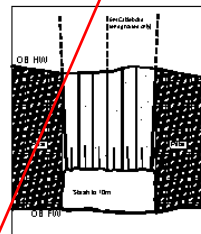
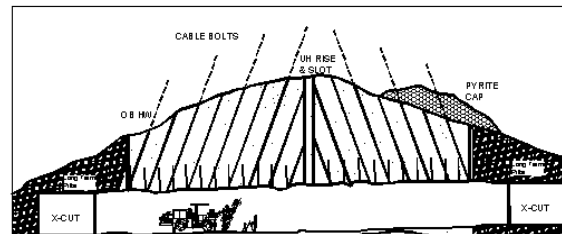
Phase 3 – Cable Bolting

Phase 4 - Extraction

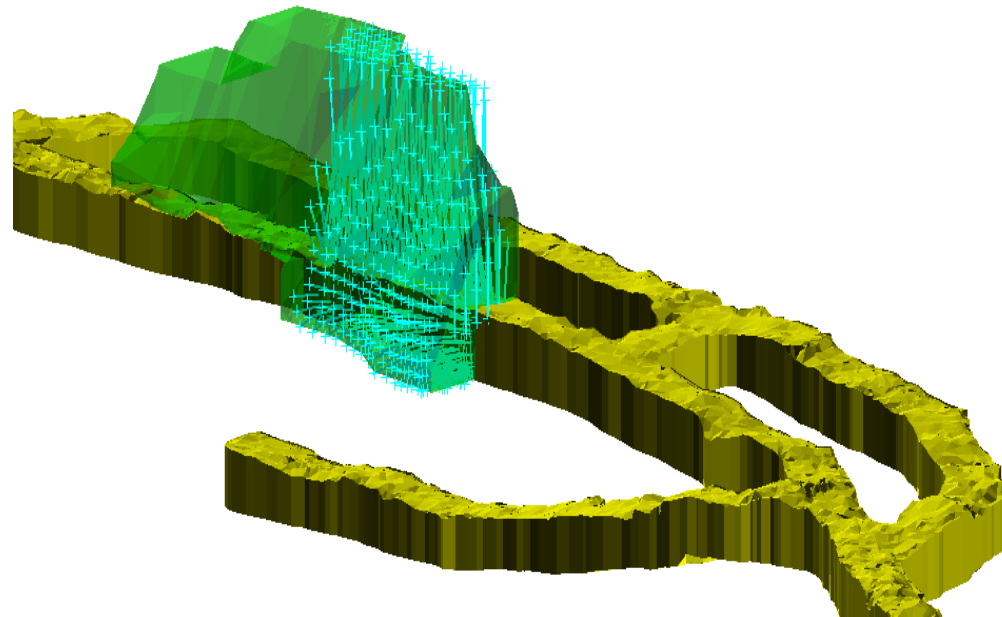
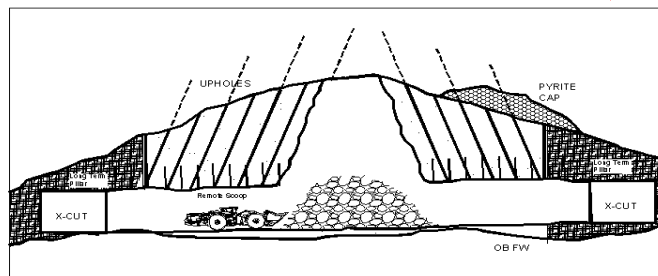
Production Drilling



Cablebolt Drilling and Installation



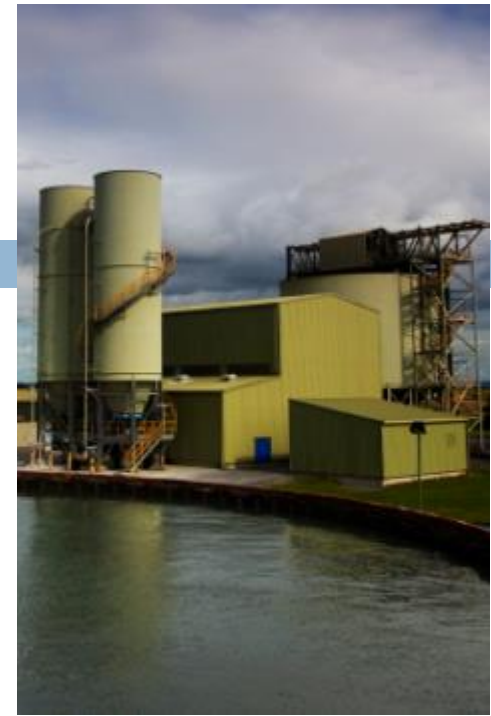
Extraction



Underground – Remote Mucking in a Longhole Open Stope

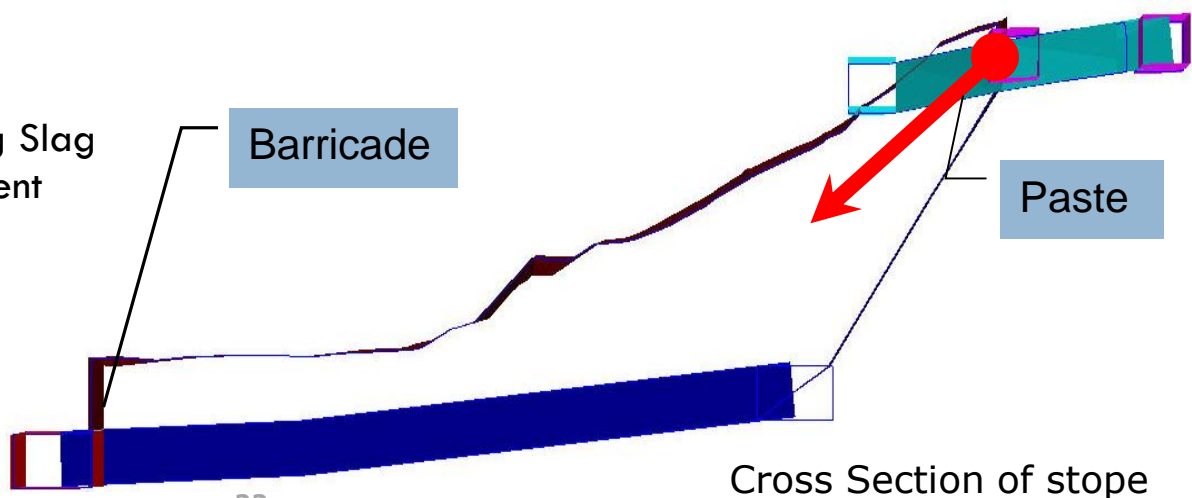
Tele-remote loading operation – operator positioned safely outside the blasted area





Underground - Backfill

- Backfill is used to provide the necessary strength fill material to facilitate extraction of secondary stopes.
- Backfill also provides support to the overlying strata in order to prevent subsidence
- The concentrator produces approximately 1.3Mt of tailings (finely crushed rock with the economical metal removed) per annum
- Approximately 43% of the tailings material from the concentrator is pumped underground as backfill
- Binder is Ground Granulated Blasting Slag (GGBS) and Ordinary Portland Cement (OPC)
- Dosage at 90Kg/m³
- Strength is 500kPa after 28 days



Cross Section of stope

Underground – Workshop

- All maintenance, except major overhauls carried out underground
- 4 fully fitted work bays
- 2 overhead cranes
- Lifelines for working at height
- Fully serviced with oils and air
- Klargester system for waste water



Underground - Primary Production Equipment

EQUIPMENT	NO.	MAKE
Drill Rigs	4	Atlas Copco – twin boomed jumbo
	3	Tamrock/Atlas Copco – long hole rig
Load haul dump units	9	Tamrock (6m ³), remote controlled (6)
Dump trucks	10	Tamrock (40t & 50t capacity)
Roof bolters	3	Atlas Copco
Mechanical scalers	3	Jama
Shotcrete	1	1 Active & 1 backup (Normet)
Cable Bolters	1	Tamrock



MINE RESCUE

16 trained members on 24-7 callout
Mutual Assistance arrangement in place
with Tara Mines & with Air Corps for
emergency transportation



1st Place 2012 Ireland-UK
Mine Rescue Competition

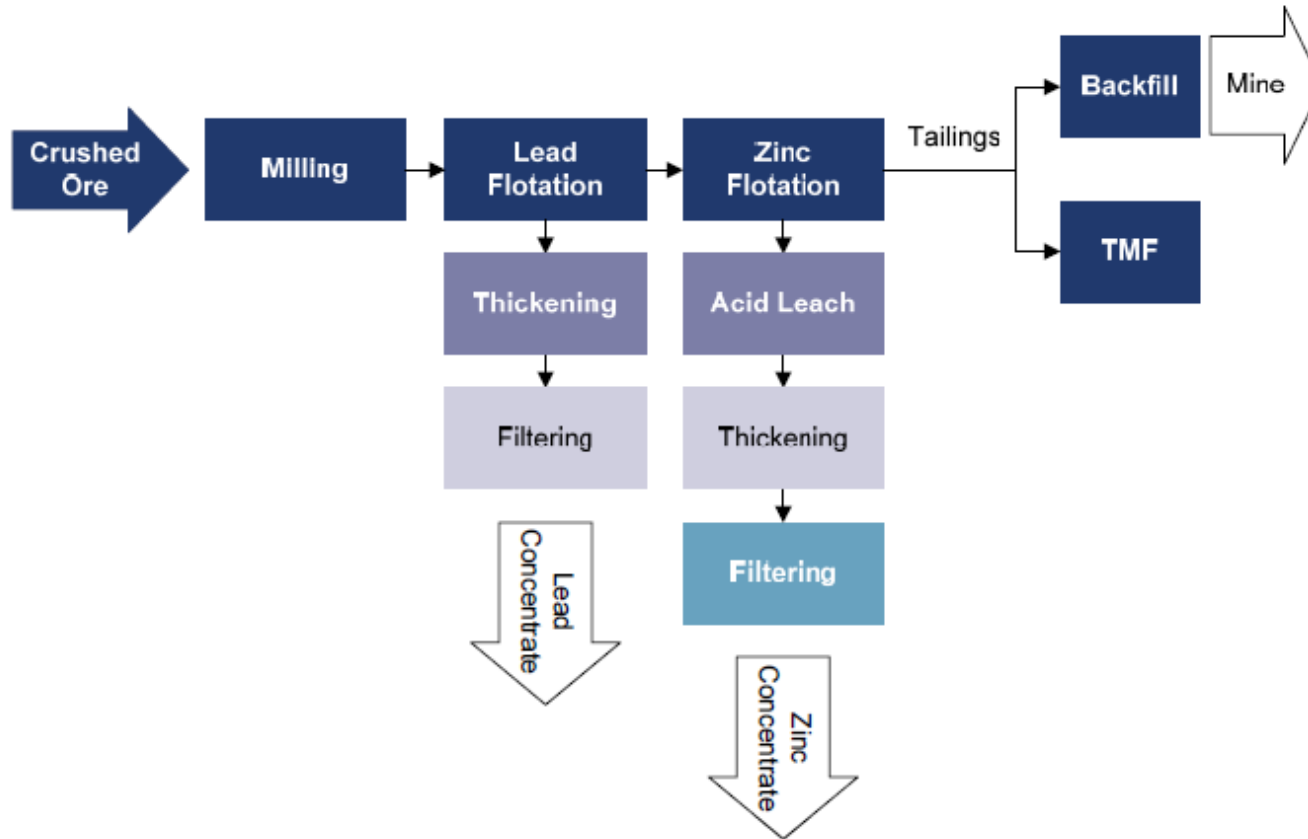
2nd Place 2013 & 2014

Metallurgical Process - Overview



- Capacity of 1.6Mt per annum
- Throughput Rate 205t/hr
- Recovery - Zinc 90%, Lead 70%
- Metal produced per annum
1 65Kt Zinc & 25Kt Lead
- Concentrate grade 53% Zinc & 62% Lead
- Zinc and Lead concentrate are trucked to the Port of Cork where they are sold to smelters in Europe and China

Metallurgical Process – High Level Process Outline



The mineral processing facility at Lisheen operates 24/7, 365 days a year at a feed rate of 4,800- 5,200 tons of ore per day

Metallurgical Process

Grinding Mills



Flotation Cells



Environmental Management

- Highly regulated by Integrated Pollution Control Licence as issued by EPA
- Key Environmental Aspects
 - Water discharges offsite
 - Tailings management
 - Mine Closure
 - Dust
 - Noise
 - Blast vibration
- Self contained environmental laboratory
- Compliance level >99% for all conditions of IPCL



Vedanta Exploration Ireland Ltd. (VEIL)

- Established in July 2014, VEIL has 4 full-time employees and 4 part-time/temporary employees, based at Lisheen Mine
- Exploring on 24 Prospecting Licence areas in Irish Midlands for carbonate hosted Lead & Zinc
- Budget of €2,000,000
- 5,000m core drilled to date
- Intent on building licence portfolio through applications and JV's
- Dominant position on Rathdowney Trend which hosts the Galmoy and Lisheen ore bodies.



Community Engagement

- Regular sponsorship of the local community's events and projects since 2008, with excess of €1.5 million spent on local community projects;
 - Moyne Templetuohy GAA Stadium
 - Moyne Indoor Athletics track
 - Upgrade of Moyne hall
 - Hurling Wall in Thurles
 - Many other small projects
- Annual Safety EXPO – local community and employees families invited 1700 attended in July 2014, over a two day period
- Community Engagement Programme formalised in 2007
- Employment +€30 Million per annum
- Financial contributions to the Government and County Council through royalties (€6 million), rates (€0.75 million).

Moyne Templetuohy GAA Stadium



People and Closure

- Significant redundancy package in place since 2010, when Vedanta acquired Lisheen from Anglo American
- Redundancies in March, July and October
- Outplacement programme in place for all employees
 - Crossroads programme run in conjunction with SIPTU
 - Training grant to all employees
 - CV preparation and interview skills
 - Start your own business courses
 - Train the Trainer courses
 - Basic IT skills courses
- Potential for Vedanta Centre of Excellence, based at Lisheen
 - Mining consultancy
 - Mining contracting
 - Supply chain
 - IT

Site Closure and Rehabilitation

- If no other use is found for the site, then
 - The Wind farm will be retained on the site post closure
 - All other surface buildings will be demolished
 - All mine access & ventilation shafts will be plugged with concrete and backfilled
 - The mine site area will be landscaped and returned to a green field site
- A fund of €25M is in place to ensure closure is completed responsibly and a further €3M is set aside for after-care for a 30 year period
- There is a Task Force in place, chaired by Liz O'Donnell (former minister) to find alternative solutions for post closure opportunities
 - A green energy hub is currently being promoted and there is significant interest

Tailings Management Facility – October 2014

Placement of Rock Cap



Conceptual Layout of Lisheen Mine Post Closure



Thank You

Questions?

