

Nuclear Structural Engineering Pty Ltd

COMPANY PROFILE

BACKGROUND

NSE is a BEE company, owned and run by Messrs. Derek Lee, Thaabit Rylands and Greg Hayter. Rizzo & Associates Inc. (PCR) of the US is another shareholder and is a well-established international engineering company that also specializes in siting and engineering support services for nuclear facilities.

Vision

We pride ourselves on our ability to tackle complex and challenging problems and provide high quality service to our valued Clients. Our vision is to remain one of the leading organisations in the field of Civil, Structural, Geotechnical, Forensic and Construction Engineering aspects of Nuclear and Industrial facilities.

CORE BUSINESS

NSE provides specialist engineering services in the following areas:

- Structural analysis, including linear and non-linear, static and dynamic analyses;
- Structural design of reinforced / prestressed concrete and steel structures;
- Seismic analysis and design, including soil structure interaction;
- Impact analyses;
- Vibration analysis and design, including foundations for large vibrating machinery;
- Analysis of structures prone to wind induced vibrations;
- Seismic walkdowns, assessments and fragility analyses;
- Assessment, rehabilitation and strengthening of existing structures;
- In-service inspections for nuclear power plant infrastructure and other industrial facilities;
- Quality control for on-site construction activities on industrial and nuclear plants;
- Assessment of concrete in aggressive environments and the specifications for repair;
- Developing laboratory testing and test specifications for concrete in nuclear and industrial facilities;
- Laboratory and in-situ determination of dynamic soil properties;

- Independent third-party reviews;
- Project management;
- Training structural design, and the static and dynamic analysis of structures.

In collaboration with our business partners, NSE is able to provide the following services for heavy industrial and nuclear related projects:

- Seismic qualification and margin assessment of equipment and piping;
- Siting and quantification of natural hazards, including seismic, tornadoes and flooding;
- Seismic ground motion amplification studies;

BBBEE STATUS

NSE is a 52% black owned enterprise. Our BBBEE status has been audited by SANAS approved auditors and we have achieved a Level 2 BBBEE status in terms of the DTI codes of practice. This means that clients procuring from NSE are entitled to claim 125% of all payments to NSE towards their own BBBEE recognition levels.

DIRECTORS

Thaabit Rylands Pr.Eng BSc Eng(Civil)(UCT); MSc Eng(Civil) (UCT)

Derek Lee Pr.Eng BSc Eng(Civil)(WITS); MSc Eng(Civil) (WITS)

SPECIALISTS

Prof. V Marshall and H Beushausen are contracted to NSE for specialist investigations.

CONTACT DETAILS

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CAPABILITIES

Forensic structural engineering and structural inspections of existing facilities

Our site team at Koeberg NPS has been performing the statutory building and structural inspections for Koeberg in accordance with the operating license and construction regulations applicable to plant since 2006. These include the inspections and surveillances, including the internal and external inspections of containment buildings and other safety related structures. We also perform the quarterly license binding surveillances of the containment structures. NSE personnel are contracted to routinely perform the internal and external inspections of concrete cooling water pipes during refuelling outages. We also manage the inspections of large steel gantry structures, and meteorological masts to assess structural integrity. Our personnel perform the inspections of the aseismic bearings at the Koeberg plant in terms of the in-service inspection program, as well as the static and dynamic shear modulus tests for these bearings.

NSE has also performed the structural inspections of the concrete lined tunnels of the Drakensburg Pump Storage Scheme and has participated in inspections as assessments of other infrastructure associated with hydroelectric facilities in South Africa and some neighbouring countries. NSE provided civil engineering expertise to the Federal Authority for Nuclear Regulation, in the United Arab Emirates, on the construction of the Barakah Nuclear Power Plant. Here our most experienced personnel were required to assist the UAE regulator with checking of QA and QC compliance of the plant owner and the main contractor.

NSE recently completed a 3-year contract with Exxaro, for structural integrity monitoring and project management services, on above ground mining infrastructure.

Structural engineering related to new and existing facilities

NSE provides a full range of services for state of the art analysis and design of reinforced concrete and steel structures. Included in this field of expertise is the ability to analyse and design for normal operating and extreme events including seismic, dynamic and impact loads imposed on the structure by external and internal hazards.

We have the capability to design the above effects

to international codes and standards particularly ACI, BS, SANS, AISC and Eurocode.

Together with our overseas partner, we have the ability to qualify plant equipment, piping, and supports. Included are plant walk downs, experience-based qualification using in house data bases, and qualification by analysis.

Seismic Structural Engineering

NSE offers a full line of services for seismic analysis, design, and re-qualification of general, industrial and particularly, nuclear power station structures. This capability includes the design of upgrades and modifications, including the assessment of building analysis models; soil structure interaction effects; floor response spectra; and implementation of regulatory requirements for seismically classified SSC at Nuclear Power Plants.

NSE provides expertise in soil-structure interaction, including interpretation of results from field and laboratory investigations of subsurface soils, vibratory ground motion, site seismic response, and state-of-the-art methods which explicitly treat important issues such as damping, frequency dependent compliance functions, effects of embedment, effects of layered subsurface profiles, and other uncertainties.

Excavation and foundation design of general and safety classified structures.

NSE is able to provide excavation and foundation designs for key structures inclusive of soil remediation and dewatering.

In order to support the seismic and dynamic response of structures we have associations with local specialists to undertake in-situ measurement of the dynamic response characteristics of soil and rock profiles as well as with an international soils laboratory which undertakes specialist dynamic soil testing including centrifuge testing.

Using these dynamic parameters, we are able to assess the response of a site to seismic ground motion, including the interpretation of the inherent uncertainty in the field and laboratory determined soil data, residual strength, liquefaction potential, dynamic bearing capacity, seismic induced settlement, and amplification of ground motion.

Siting of new facilities

NSE provides a comprehensive siting service based on the topology of the site, the geotechnical/geologic conditions, the cooling water requirements and an understanding of the layouts for fossil,



hydro and nuclear Power Stations.

Seismic Hazard Evaluation

NSE together with their overseas partner provides inputs to seismic hazard assessments and the development of design basis ground motion for the design of structures.

NSE has access to databases and software for full Probabilistic Seismic Hazard Assessments based on the USGS codes and a library of ground motion models.

External Hazards

NSE provides the capability of assessing the hazards from external natural events such as tornado, flooding and extreme wind to supplement the loading catalogue for the facility under consideration.

Risk Assessment

NSE has the capability of assessing consequences and quantifying the risk associated with external and internal hazards associated with Nuclear power plants, water retaining and tailings / ash dams.

Nuclear Licensing Support

NSE provides engineering support for the development of new build Nuclear Power Stations as well as the re-qualification of existing Nuclear facilities.

We have experience dealing with the South African National Nuclear Regulator and are familiar with the regulatory guidelines and publications of USNRC and other regulatory bodies such as IAEA.

PROJECT EXPERIENCE

Example Projects

Koeberg Nuclear Power Station

- Undertook the inspections, non-destructive testing and assessment of the containment buildings, which have been affected by chloride induced corrosion.
- Performed the quality control function for the execution of the repairs to the containment buildings.
- Quality control functions for various civil engineering projects and modifications.

- Inspections that constitute the civil in-service inspection programme of the power station as well as condition inspections of gantries and buildings.
- Seismic inspection, walk downs and assessment of Electrical Building, Fire Station Building and ACP2 emergency control centre.
- Inspection and structural evaluation of the 120 m high meteorological mast including re-tensioning, repainting and installation of the new tension monitoring system for the stay cables.
- Structural evaluation of the Turbine Hall floor abnormal loading.
- The seismic design of remedial measures to the emergency diesel generator exhaust stacks.
- The design of the flood mitigation measures in the RRI pump and heat exchanger rooms.
- Monitoring and testing of the aseismic bearing samples for the nuclear island.
- Design of the seismically qualified masonry works within the radiation protection offices.
- Analysis and design of a stiffening wall to the spent fuel pool for the re-racking project.
- Static and dynamic analysis of the CRF Intrusion Barrier, to dynamic wind loadings including CFD analyses.
- Aircraft crash assessment.
- Turbine missile assessment on the shield wall between containment and Turbine Hall.
- Design and specification of new interim storage facility for spent fuel storage casks.
- Dynamic impact drop analysis of spent fuel cask in Fuel Building.
- Seismic Analysis of the Cask Storage Building (CSB) for design and beyond design basis earthquake
- Design of modifications for the CSB to prevent collapse under design and beyond design basis earthquakes.
- Assessment of the PTR floor slab and bund wall following equipment failure during a seismic event.
- Relocation of 2 loaded spent fuel casks (114 ton each) and old reactor vessel head (72 ton).

Lesedi Nuclear Services (LNS):

- Analysis and assessment of steel platforms in the Steam Generator (SG) cubicles at Koeberg NPS.
- Obtain geotechnical information for the Ankerlig power station extension. Analysis and design of the Turbo-Generator (TG) foundations for 3 No. 30MWe natural gas turbines, and the design of the fuel storage



tanks.

- Provide civil engineering expertise to the SALTO scoping project for long term operation of Koeberg NPS.

South African Nuclear Energy Corporation SOC Limited (Necsa):

- Seismic evaluation of the Safari Reactor building, NTP and other buildings at the Pelindaba facility.

Eskom AHTR Concept design:

- Investigation into the structural parameters that contribute to the prestressed concrete reactor vessel structural capacity, for the Advanced High Temperature Reactor.

Group Five Construction (Propriety) Limited

- Prediction analysis of the deflection of the Polar Crane main girders with the Temporary Lifting Device (TLD) and new Steam Generator load.

Waltloo Petroleum Fuel Depot Buildings –

- Blast analyses and design of Waltloo petroleum fuel depot buildings and surrounding tank farms.
- Hazard studies for the Waltloo Depot.
- A vulnerability analysis for the Waltloo Depot.

Medupi Power Station:

- Expert advice for the seismic analysis and design of the fossil fired power station comprising 6 x 800 MW units. Development of a seismic procedure for the analysis of transmission line structures.
- Structural assessment on the Air Cooled Condenser Condensate Tank civil support structure:

LLOYD'S REGISTER EMEA – Abu Dhabi Registered branch:

- NSE provided expert Civil and Structural Engineering Nuclear Inspection Services to Barakah NPP, in support of the UAE regulator (FANR).

PBMR Fuel Plant

- Re-qualification of existing civil engineering structures for the fuel fabrication plant for Pebble Bed Modular Reactor. This included

analysis and design of modifications for extreme loads such as seismic, blast and tornado.

- Assistance to the Client in developing the seismic safety case and writing of the Safety Analysis Report for the facility.
- Discussions with the National Nuclear Regulator regarding the seismic methodology prior to submission of the seismic safety case.

Eskom Nuclear 1 Programme –

- Provision of civil engineering design services for future nuclear sites. This work included, power station layouts, infrastructure design, cooling water works, and seismic hazard assessments for the nuclear facilities.
- Development of site safety reports and safety analysis reports.

Golder Associates Africa (Pty) Ltd

- Provision of specialist advice for the design of the reinforced concrete penstock tower, the temporary penstock towers and concrete pipe encasement for the new tailings dam at Southdeep Mine.
- Finite Element analysis and structural assessment of the Macrodump Jacked pipe.

Saudi Aramco Refinery

- Seismic Walkdown of the Saudi Aramco refinery in the Yanbu, Kingdom of Saudi Arabia.

Encon Engineering Projects

- Shear strengthening of mezzanine floor T-beams using externally bonded FRP sheets.

Matimba Power Station

- Independent assessment of repairs to the stacker-reclaimer structure.

Sasol Midlands Plant

- Static and dynamic analysis and design of the foundation of the compressor used to convey hydrogen from the Sasol Midlands site to the Sasol One site.

Drakensberg Pumped Storage Scheme

- Dewatering of the headrace, pressure shaft, pressure tunnel and penstocks