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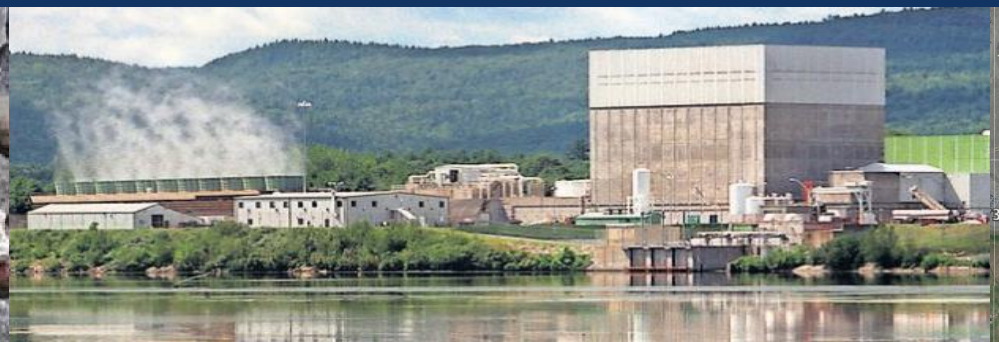
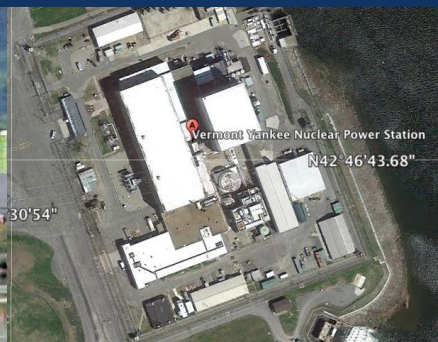
Nuclear Decommissioning Citizens Advisory Panel Meeting

Thursday, September 28, 2017
Presented by: Doug Larson, P.E.

Rubblization and Recycling of Concrete

Safe Driving: Winterizing Your Vehicle

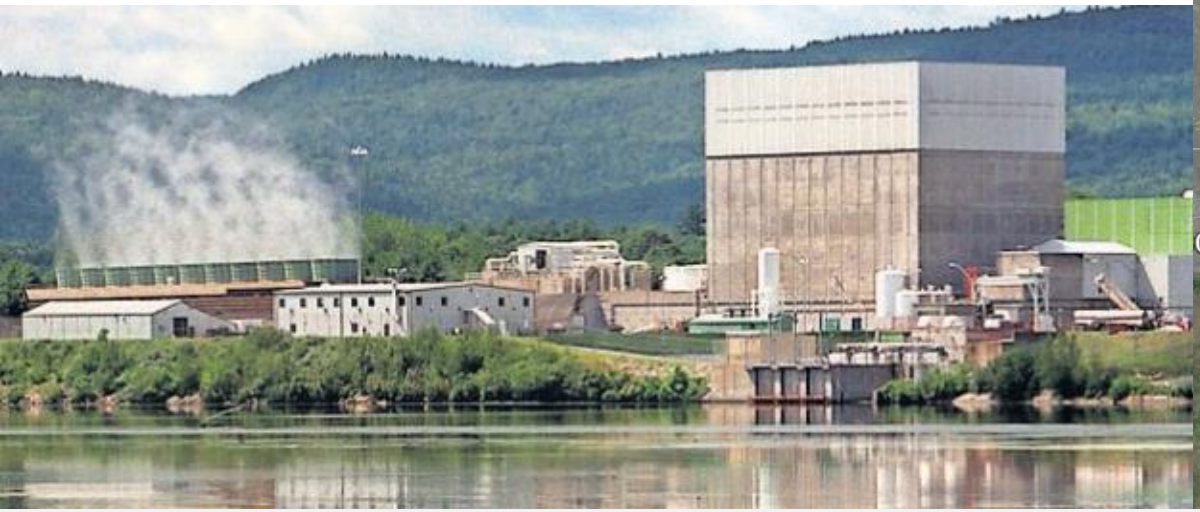
Driving in the winter means snow, sleet, and ice that can lead to slower traffic, hazardous road conditions, increased road rage, and other unforeseen dangers. Here are some suggestions from the National Safety Council to make sure that you and your vehicle are prepared for hazardous winter conditions.

Tips for winterizing your vehicle:

- **Check the weather.** Weather affects road and driving conditions and can pose serious problems. Monitor forecasts on the Web, radio, TV, cable weather channel, or in the daily papers.
- **Prepare your car for winter.** Get your car a winter checkup to make sure everything is in good working order.
- **Have necessary equipment.** Carry the following items in your trunk: a full tank of gas, fresh anti-freeze, properly inflated spare tire, wheel wrench and tripod-type jack, shovel, jumper cables, tow and tire chains, bag of salt or cat litter, and a tool kit.
- **Pack essential supplies.** Be prepared with a "survival kit" that should always remain in the car and contain items, like working flashlight and extra batteries, compass, first-aid kit, ice scraper and brush, and non-perishable, high-energy foods like unsalted canned nuts, dried fruits, and hard candy.

Presentation Outline

- **Introduction to Geosyntec**
- **Recycled Concrete Overview**
- **Challenges of Reuse**
- **Benefits of Reuse**
- **Future Site-Specific Engineering Considerations**
- **Q&A**



Introduction to Geosyntec

Principal Areas of Practice

- Contaminated Site Assessment and Cleanup
- Environmental Planning and Management
- Building Health Evaluations and Rehabilitation
- Air Quality Management and Air Pollution Control
- Water and Natural Resources Assessment, Management, and Restoration
- Water and Wastewater System Planning, Engineering, and Design
- Waste Management Planning, Engineering, and Design
- Civil Site Engineering and Design
- Geotechnical and Geological Analysis, Modeling, and Engineering
- Structure and Fluid Analysis, Modeling, and Engineering
- Facility Hazard Definition and Risk Management

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Geosyntec is a leading provider of high-value services, first-to-field deployment of emerging technologies, and innovative solutions to address new ventures and complex challenges involving the environment, natural resources, and infrastructure for private and public clients.

Market Sectors/Client Types

- Aerospace and Electronics
- Chemicals and Petrochemicals
- Government: Federal – DoD, **DoE**, NASA, EPA,
- Government: State and Municipal
- Manufacturing
- Mining and Ore Processing
- **Nuclear Decommissioning**
- Oil and Gas
- Pharmaceuticals and Biotechnology
- **Power and Utilities** - Coal Combustion Residuals
- PRP Groups
- Real Estate
- Sediment Sites, Ports and Harbors
- Superfund- CERCLA NPL and State
- Transportation
- **Waste Management: Solid and Hazardous**

Select Relevant Project Experience

- **U.S. DOE Fernald Uranium Processing Facility Decommissioning, OH**: On Site Disposal Facility Closure Permitting, Design and Construction QA/QC; 2.5 million tons of contaminated soil and debris, 1.3 million tons of waste, 31 million tons of nuclear product. Grand Award American Council of Engineering Companies
- **Waste Control Specialists LLRW Site, TX:** Construction Oversight, Engineering Certification and review of design and permit submittals for Texas Commission on Environmental Quality (TCEQ), Byproduct Materials Landfill, Federal Waste Facility, and Vermont Compact Facility
- **U.S. DOE Portsmouth Gaseous Diffusion Plant, OH:** Remedial Investigation and Feasibility Study for disposal options, and Design of On Site Disposal Facility; 4 million cubic yards of waste materials from D&D activities
- **Rare Earth Facility Nuclear Decommissioning, Malaysia**: Design and Construction of a Low-Level Radioactive Material Treatment and Final Disposal Facility

Rubblization Considerations

- **Rubblization is an acceptable U.S. Nuclear Regulatory Commission decommissioning option** generally described as the operations whereby **above-grade concrete structures are demolished and placed below grade**. A desired goal is to **produce a site with unrestricted-use license termination**, and has no requirement for ongoing monitoring of radioactivity in the subsurface.
- **NRC: 10 CFR Part 20—Standards for Protection Against Radiation; § 20.1402 Radiological criteria for unrestricted use**. A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that **does not exceed 25 mrem** (0.25 mSv) per year, including that from groundwater sources of drinking water, and the **residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA)**. Determination of the levels which are **ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal.**

Recycled Concrete Aggregate

- **Rubblization** would result in the development of **Recycled Concrete Aggregate (RCA)**.
- **RCA use is common**, accepted by most states and jurisdictions and **has widespread approval.**
- **Site decommissioning could be accomplished** through a combination of **rubblization/reuse of acceptable RCA meeting site release criteria**, and removal of other wastes to be disposed offsite (hazardous and non-hazardous wastes, LLRW, and LLMW).

Why Recycle Concrete?

Vermont Department of Environmental Conservation - Agency of Natural Resources: ***"Recycling or reusing project by-products across the State can make a large impact in resource conservation and mitigating landfill use."***

Recycling concrete **has two main advantages**: it **reduces use of virgin materials** and associated costs, and **reduces unnecessary landfill of valuable materials**.

Natural Resource Preservation

- Aggregate mining resources preserved, no impact to borrow sites
- Less consumption of raw materials; saves oil, water, coal and gas

Environmental Protection

- Less transportation needed (less fuel)
- Lower emissions, noise, dust
- Less waste to be disposed off-site
- Preservation of limited landfill space
- Substantial savings of water and emissions of CO2

Other Benefits

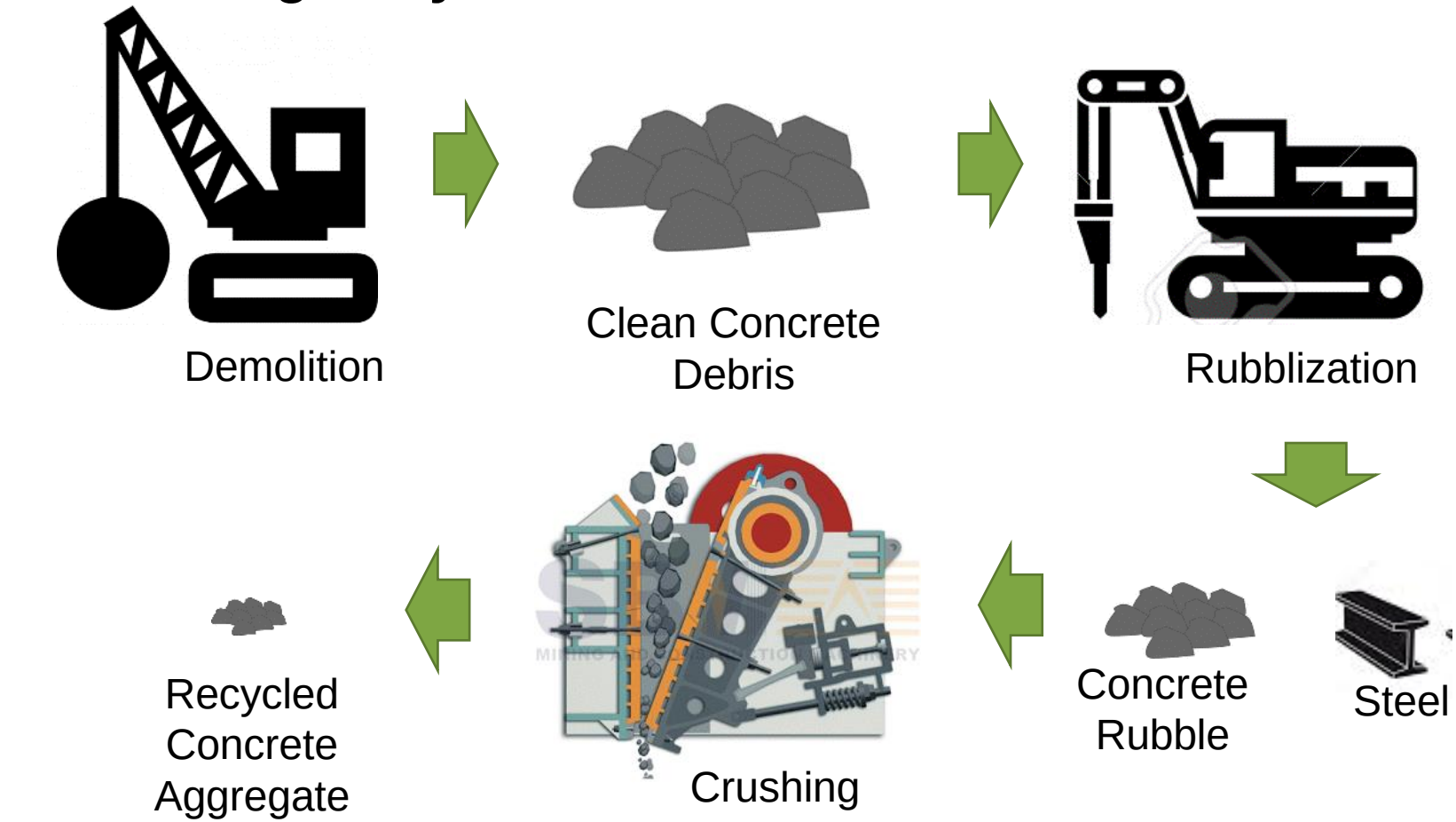
- Less time needed - lower labor cost
- Less transportation - lower cost, saves roads, reduces potential roadway accidents
- Landfill cost savings

Recycled Concrete Overview

Typical Uses

- General backfill
- Erosion control materials - riprap, riparian structures
- Granular backfill for construction, structural fill
- Subbase for road, parking lots, walkways, etc.
- Landscaping
- Pipe bedding

Processing Recycled Concrete



Recycled Concrete Overview

Processing Recycled Concrete

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Recycled Concrete Overview

Material Management

- Controlling material properties (sizing of crushed material)
- Segregation of “clean” and “impacted” material
- Staging of processed material for subsequent re-use
- Other process streams:
  - Steel (off-site recycling)
  - Unsuitable Impacted Material (off-site disposal)

Stockpiled RCA Material

Environmental Considerations

- Noise
- Air
- Stormwater
- Groundwater

Dust Control During Demolition

Example of a Containment Area

Challenges of Reuse

Stormwater Runoff Control

Management of Change in Material Properties

Geotechnical and Environmental

Worker Safety Considerations

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Benefits of Reuse

Public Safety

- Reduced truck traffic (export AND import)
- Operations contained in secure site with designated safety personnel

Sustainability

- Consistent with Vermont's effort to reduce solid waste and recycle/reuse project by-products
- Reduced carbon footprint

Future Site-Specific Engineering Considerations

Geotechnical Considerations

- Material would be crushed to < 10 inch
- Clean RCA placed below surface grade
- Surface cover over the RCA would bridge the surface voids and provide a working platform for future land use
- Combination of remaining building foundation components and RCA will have high compression strength

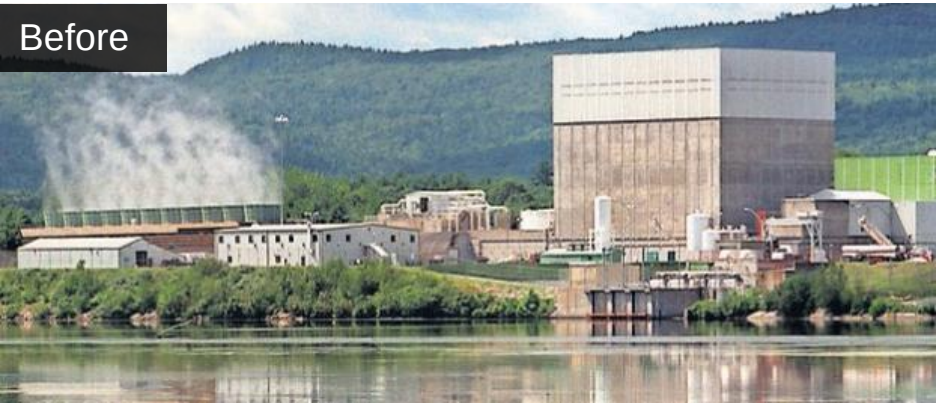
Future Site-Specific Engineering Considerations

Environmental

- Temporary noise impacts during demolition
- Dust suppression equipment and monitoring
- Leachability of RCA with stormwater infiltration
  - Prescreening concrete to determine clean material
  - Restored surface cover and grading to limit infiltration in these areas
- RCA/groundwater interaction

Summary

- Recycled concrete is a suitable construction material for a variety of applications and is widely recognized and specified by multiple federal and state agencies;
- Concrete that is characterized as clean can be used as an environmentally safe fill with proper engineering; and
- Reuse of suitable demolition debris can reduce safety risks, conserve resources, and lower carbon footprint.



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Thank you.

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Project Snapshots

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Radiological Waste Management

Between 1995 and 2006 (final closure), Geosyntec provided all studies, RESRAD modeling, engineering, design, permitting, construction plans and specifications, pilot testing, support plans, resident engineering, and CQA for the Fernald Uranium Feed Materials Production Center On-Site Disposal Facility (OSDF) in Ohio, a 62 acre, 3-million cubic yard capacity long-term disposal facility for uranium ore processing plant D&D waste, contaminated soils, and solidified sludges (MLLRW). Geosyntec worked as a subcontractor to DOE's overall site management contractor, Fluor Fernald, Inc., designing a facility with eight contiguous cells that were sequentially constructed, filled, and closed. Geosyntec achieved a precedent-setting schedule for a mission-critical DOE project: from start of Title 1 design to start of construction in only 15 months. Geosyntec personnel were essential in gaining timely regulatory acceptance and community support. The OSDF design includes a double-composite liner system; leachate collection, storage, and transmission systems; stormwater management system; cover system; biointrusion barrier; environmental monitoring systems; and other components.

Design and CM/CQA for a U.S. Department of Energy (DOE) Low-Level Radioactive Waste Disposal Facility in Ohio

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Radiological Waste Management

Geosyntec is the construction manager at risk and designer of a new facility to dispose of thorium- and uranium-containing residuals from a rare earth ore processing facility. The residuals were originally stored in an aboveground facility designed as a secure, but relatively short-term solution. Geosyntec was retained by the owners to develop a long-term solution for disposal of these residuals that is both secure and protective of human health and the environment. Geosyntec designed a system whereby 80,000 residual-containing drums were retrieved from the existing storage facility, stabilized, inventoried, and placed in newly constructed underground vaults. Geosyntec's approach required the design and construction of an on-site drum processing facility as well as a landfill structure to contain the underground vaults and the D&D materials from the former storage facility. The project is now at substantial completion with more than 3,500,000 labor hours of work without a recordable safety incident.

Design and Construction of a Low-Level Radioactive Material Treatment and Final Disposal Facility in Malaysia

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Contaminated Site Program Investigation, Design, and Implementation Services at the NASA Kennedy Space Center in Florida

Environmental

For more than 15 years, Geosyntec has provided a wide range of technical services to Kennedy Space Center for the investigation, design, and implementation of remedial actions in support of NASA's environmental mission. We have conducted contaminated site closure process activities through more than 85 delivery orders at more than 50 separate locations across the installation with the goal of driving sites toward closure (75% have achieved no further action required or long-term monitoring status to date). Site contaminants have included PCBs, chlorinated solvents, paints, oils, lubricants, petroleum hydrocarbons, and a variety of chemicals associated with rocket launches during the lunar program and the Shuttle era. As part of this remediation program, Geosyntec worked with NASA scientists to develop innovative approaches to in situ treatment that earned recognition from the Space Foundation for their potential contribution to the advancement of remediation technology for civilian applications.

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Environmental

Since 1999, Geosyntec has been working with Robins Air Force Base on major environmental restoration, compliance, and sustainability programs. These have included evaluation of contaminated groundwater collection and treatment performance, development of a base-wide stormwater management program, and sustainability initiatives ranging from pollution prevention opportunity assessments of aircraft painting systems and renewable energy evaluations to innovative control technologies for hangar HVAC systems.

Comprehensive Environmental Restoration, Compliance, and Sustainability Program Support for Robins Air Force Base in Georgia

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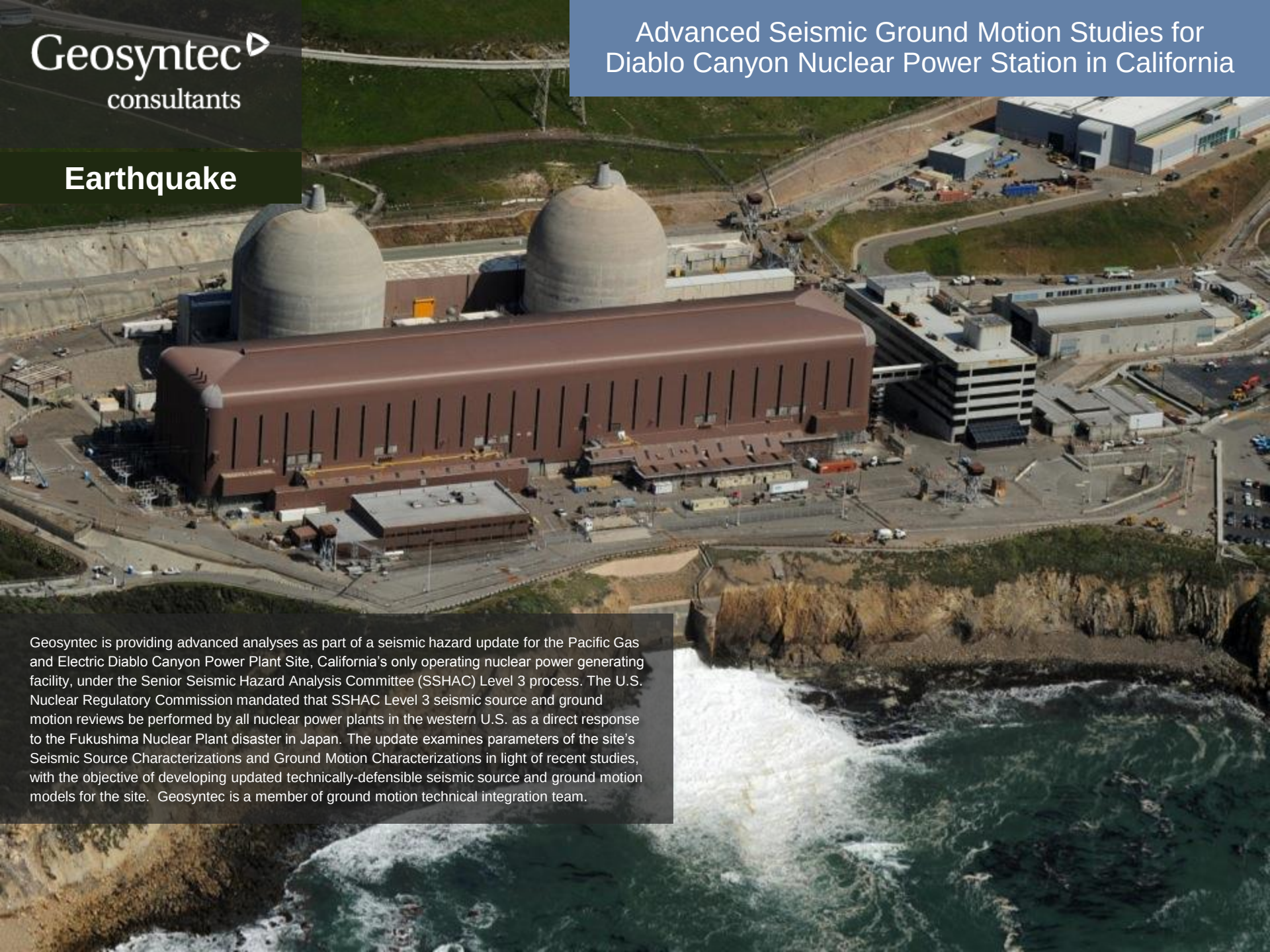
Advanced Seismic Ground Motion Studies for Diablo Canyon Nuclear Power Station in California

Earthquake



Geosyntec is providing advanced analyses as part of a seismic hazard update for the Pacific Gas and Electric Diablo Canyon Power Plant Site, California's only operating nuclear power generating facility, under the Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 process. The U.S. Nuclear Regulatory Commission mandated that SSHAC Level 3 seismic source and ground motion reviews be performed by all nuclear power plants in the western U.S. as a direct response to the Fukushima Nuclear Plant disaster in Japan. The update examines parameters of the site's Seismic Source Characterizations and Ground Motion Characterizations in light of recent studies, with the objective of developing updated technically-defensible seismic source and ground motion models for the site. Geosyntec is a member of ground motion technical integration team.

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Nuclear

MMI Engineering is working with Sellafield Ltd on elements of a new intermediate-level radioactive waste encapsulation plant proposed for the Sellafield complex. Assignments have included development of models to examine localized releases of hydrogen, heat, and water vapor. In addition, MMI built a detailed ventilation network model to assess thermal and buoyancy effects in the event of equipment failures.

Advanced Safety Engineering Analyses for New Waste Encapsulation Process at Sellafield Nuclear Materials Processing Facility in United Kingdom

Geosyntec Services

Contaminated Sites
- Conceptual Site Model Development
- Contaminated Media Investigations and Assessments
- Remediation: Soil, Groundwater, Sediments
- Brownfield Redevelopment Planning and Design
- Specialized In Situ Treatment Technologies
- Risk Assessment and Applied Toxicology
- Vapor Intrusion
- Data Interpretation, Synthesis, Visualization, and GIS
- Detection and Culturing of Microbes for Environmental Applications
- Fate and Transport Studies and Modeling, Forensic Studies
- Feasibility Studies and Remediation System Design
- Human Health and Ecological Risk Assessments
- Regulatory Strategy and Cleanup Goal Development
- Remediation System Implementation, Operation and Optimization
- Treatability and Pilot Studies

Environmental Management
- Environmental Liability Valuations
- Environmental Management System Development and Implementation
- Environmental Permitting and Compliance Assurance
- Industrial Hygiene Services
- Transactional Due Diligence

Air Quality
- Air Dispersion Modeling
- Air Emission Permitting and Compliance Evaluations
- Air Pollution Control Evaluations and Performance Assessments
- Air Quality Monitoring and Studies
- Continuous Emission Monitoring System Design and Implementation

Waste Management
- Facility Decontamination and Decommissioning
- Landfill Gas and Leachate Management
- Radiological Waste Management and Disposal Facilities
- Solid, Industrial, and Hazardous Waste Facilities

Water and Natural Resources
- Erosion and Sediment Control
- Discharge Permitting and Receiving Water Studies
- Environmental Impact Studies, Licensing and Compliance
- Integrated Water Resource Management Planning, Water Supply Natural Resource Damage Assessment, Monitoring
- Remote Real-Time Control and Optimization of Water Infrastructure
- Stream, Reservoir and Lake Studies and Restoration
- Wetland Delineation and Permitting
- Industrial Wastewater Engineering and Design

Civil and Geotechnical
- Earth Retaining Structures and Excavation Support
- Earthquake and Geohazard Engineering, Evaluation and Mitigation
- Geotechnical and Geostructural Engineering
- Levees, Dams, and Subsurface Hydraulic Barriers
- Seismic Hazard Evaluation and Ground Motion Studies
- Ground Improvement Engineering
- Soil and Structure Interaction Studies
- Specialty and Conventional Structural Foundations

Structural Analysis and Fluid Engineering
- Computational Fluid Dynamics Modeling
- Design of Offshore Structures, Risers, and Umbilicals
- Extreme Load Analysis
- Nuclear Facilities Structural Analysis and Civil Engineering
- Smoke and Gas Dispersion Modeling
- Structural Health Monitoring
- Structural Mechanics and Civil Engineering

Facility Hazards
- Blast Protection Assessment and Design
- Emergency Planning
- Quantitative Risk Assessments
- Regulatory Compliance
- Safety System Survivability Assessments and Audits
- Technical Due Diligence