

Nuclear Energy University Programs

NEUP Quality Assurance

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Delivering The Goods Requires Good Quality Assurance

“It’s not about writing
research papers anymore,
you’ve got to deliver the
goods.”

Secretary of Energy
Dr. Steven Chu



Video on Delivering the Goods





Obtaining and Using University Data





Quality Assurance Is Crucial for the Success of the Nuclear Renaissance

We are not merely doing Quality Assurance just for the sake of meeting regulatory requirements or ensuring that work continues to get funded or is even accepted by Industry or NRC (which are huge reasons by themselves to produce high quality products and services)

● We can't afford another 30 years of the same energy setbacks

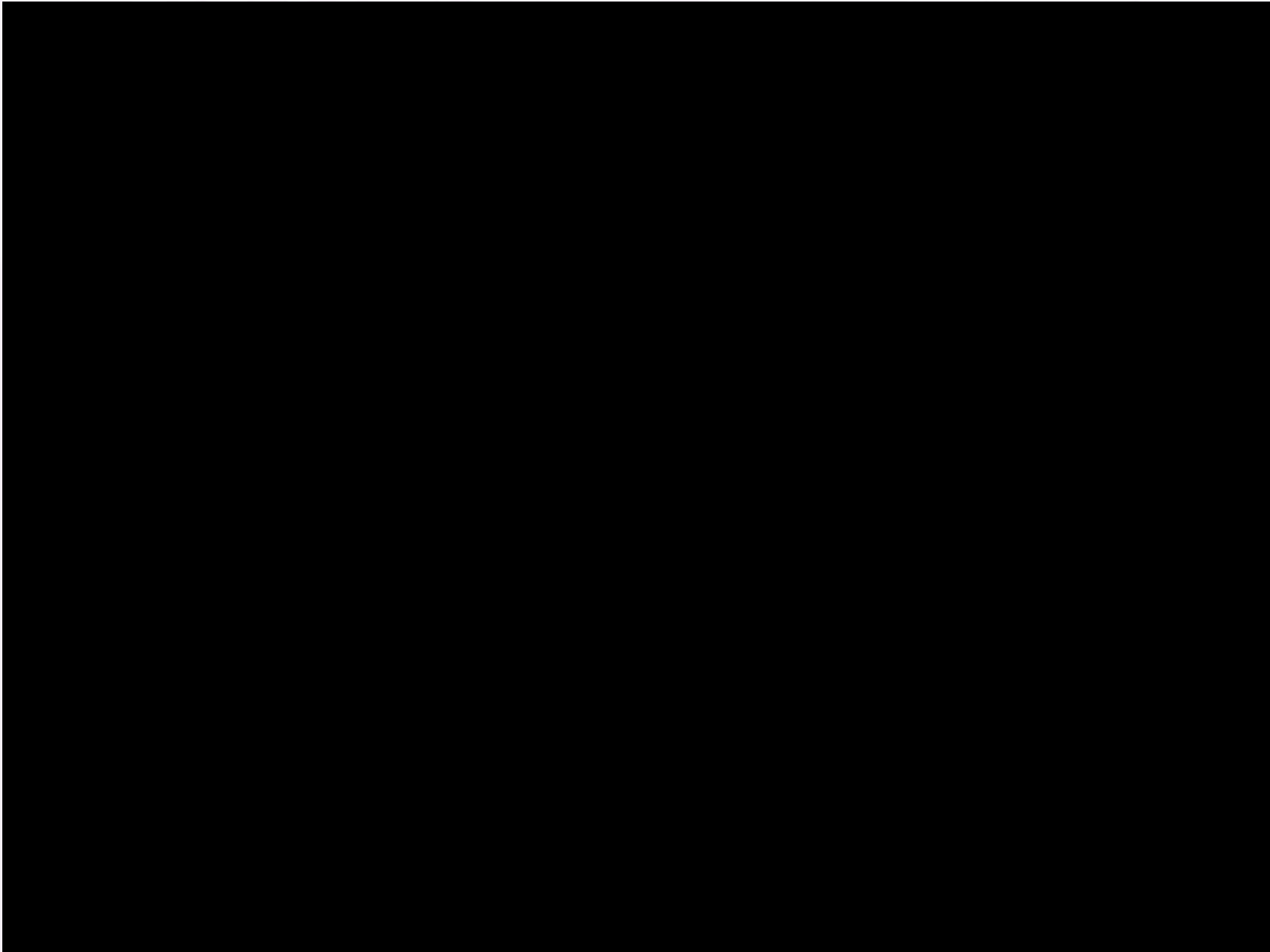
Quality Assurance is crucial to:

- Gaining the trust of the American and World populations
- Ensuring the future of nuclear energy and energy independence
- Ensuring we have sustainable power production for centuries to come
- Maintaining the national security of our country through energy independence



QA is Doing Things Right the First Time







Questions

Did the man scraping snow do things right? Did he do the right thing?

How many of you would fly with an airline that had a:

- 10% failure rate on parts safety related components
- 5%
- 1%

Where is your research going to end up?

Would you live by a nuclear facility with known quality defects in the safety systems or operated the systems with nonvalidated data/research?



Why Quality Is Necessary

- Research shows that for every Quality defect, issue, or problem not found (or found and NOT solved) during R&D through design the cost is approximately 100 times more to fix after it has been implemented (this does not include legal costs).
- Most Quality problems do not cause immediate problems and sometimes take years to show up. But the consequences are significant, costly and sometimes fatal when they do!
 - A defect in a Soviet early-warning monitoring system nearly brought on nuclear war in 1983. The software was supposed to filter out false missile detections caused by Soviet satellites picking up sunlight reflections off cloud-tops, but failed to do so. Disaster was averted when a Soviet commander, based on what he said was a '...funny feeling in my gut', decided the apparent missile attack was a false alarm.
 - In August 1991 the concrete base structure for a North Sea oil platform imploded and sank off the coast of Norway, reportedly due to errors in initially-used (R&D) design software. The enormous structure, on hitting the seabed, reportedly was detected as a magnitude 3.0 seismic event and resulted in a loss of \$700 million



Why Quality Is Necessary

- In April of 1999 a software defect caused the failure of a \$1.2 billion U.S. military satellite launch, the costliest unmanned accident in the history of Cape Canaveral launches. The failure was the latest in a string of launch failures, triggering a complete military and industry review of U.S. space launch programs, including software integration and testing processes. Congressional oversight hearings were requested.
- A software defect was determined to be a major contributor to the 2003 Northeast blackout, the worst power system failure in North American history. The failure involved loss of electrical power to 50 million customers, forced shutdown of 100 power plants, and economic losses estimated at \$6 billion. The error was found and corrected after examining millions of lines of code.



Why Quality Is Necessary

- At least 34 people died due to Toyota's Quality Problems with their gas pedal and braking system. (Quality problem became a safety problem)
- 8.5 million vehicles were recalled
- The cost of quality has been estimated at well over 2.5 billion dollars (this does not include law suits, public relations/advertising or loss of value in shares – which dropped 20%)
- Repairs and apologies have not satisfied the customer or gained their trust that the faulty vehicles are safe – 20% of customers have switched to another car brand
- Congress has called for **criminal** investigation into Quality and Safety problems.



Lessons From History

Quote from GAO Report: Audits at Yucca Mountain identified quality assurance problems in three areas:

1. data sources
 2. validation of scientific models
 3. software development
- DOE could not ensure that all the data needed to support the scientific models could be tracked back to original sources or that the data had been properly collected.
 - DOE had no standardized process to develop the scientific models needed to simulate geological events.
 - DOE had no process for ensuring that the software being developed to support the models would work.



So What Does All This Mean for The University

- Universities are now under contracts which require flow down of QA requirements in accordance with DOE Order 414.1C *Quality Assurance*
- All university contracts contain QA requirements specified on the QA Requirements Form
- The Quality of university research products must be sufficient to be qualified by the NE Program or end user
- Universities are key to the renaissance of the nuclear industry
- We must train and educate students on Quality Assurance not just technical fields in order to ensure validity of research results

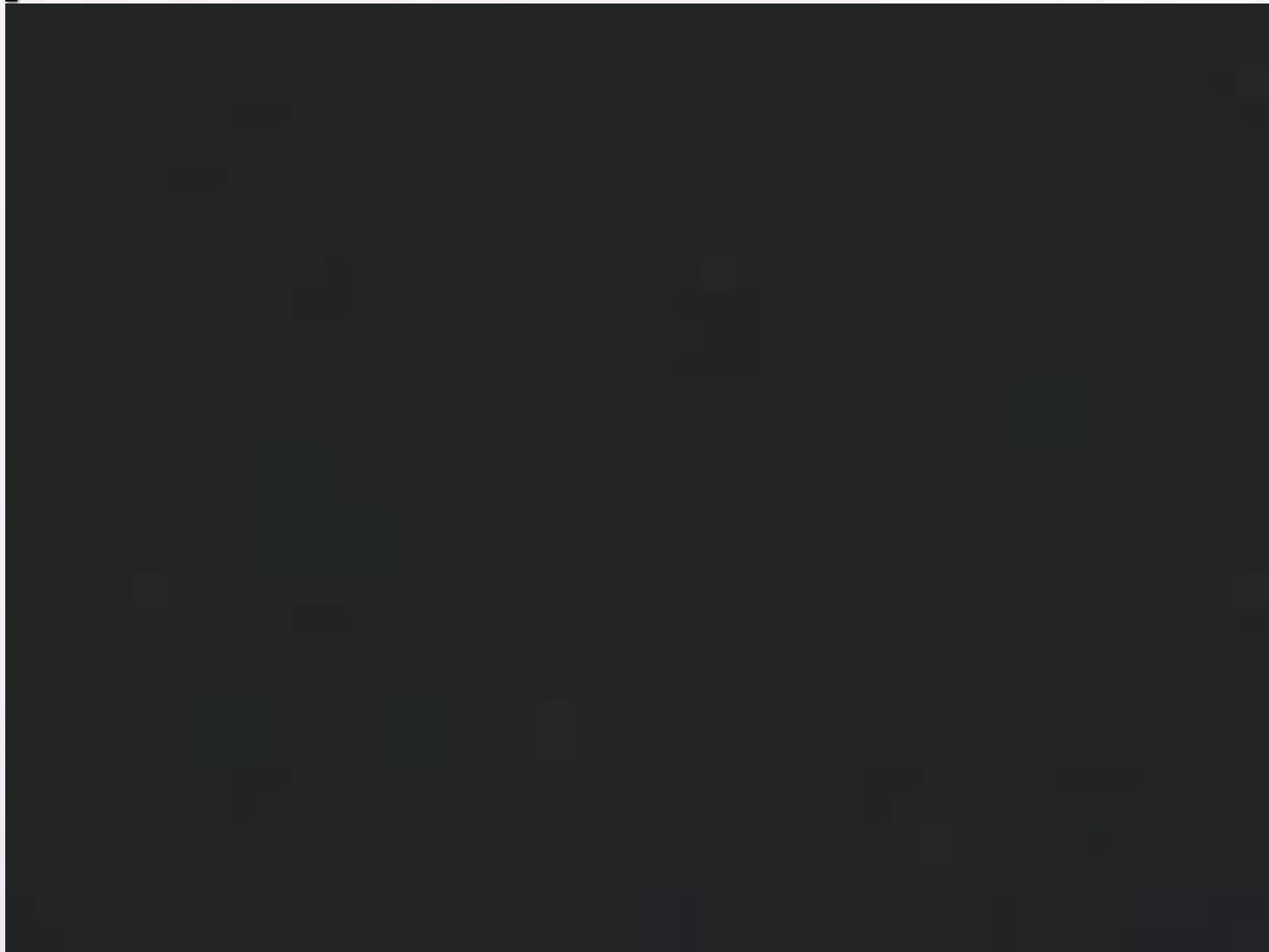


So What Does All This Mean for The University

- In order to deliver the goods when it comes to Quality Assurance funding following the requirements flowed down to the university is essential.
- There will be no second chances to make a first impression regarding the renaissance of the nuclear industry.



Emphasis on Why Quality is Important





NEUP QA Requirements

- Test Planning, Implementation, and Documentation (Research Planning)
 - Test/research methods and characteristics have been planned, documented and the approaches and procedures recorded and evaluated.
 - Characteristics to be tested/researched and test/research methods have been communicated to those performing the test/research.
 - The test/research results have been documented and their conformance to acceptance criteria evaluated.
 - Conformance Criteria has been established for tests.



NEUP QA Requirements Cont.

- Test Planning, Implementation, and Documentation (Research Planning)
 - Documentation of the test/research performance has been developed to ensure the research/test can be replicated.
 - The researcher/developer has documented work research/test methods and results in a complete and accurate manner sufficient to withstand a successful peer review.
 - Protocols on generation and safeguarding of data and process developed from research/testing has been developed to ensure consistency of R&D work.
 - The university has submitted a Test Plan/Research Plan to the funding organization for review and concurrence prior to use if requested or specified in contractual documents.



NEUP QA Requirements Cont.

- Equipment Calibration and Documentation
 - The researcher/university has specified the requirements of accuracy, precision, and repeatability of measuring and test equipment (M&TE).
 - Standard university documented procedures are implemented for equipment calibration.
 - If university M&TE procedures are not used, the effects of the instrument's performance on the uncertainty of the measurements and tests have been considered and documented in the research.



NEUP QA Requirements Cont.

- Equipment Calibration and Documentation
 - M&TE is properly controlled. The degree of control shall be dependent on the application of the measurement.
 - The university has calibration records documenting instrument calibration to a national standard as a deliverable product and has provided or will provide the documentation to the appropriate NE program or national laboratory.



NEUP QA Requirements Cont.

- Procurement Document Control
 - University procurement document control procedures/processes have been documented and implemented.
 - Procurement document specifications are being controlled.
 - The university has a documented procedure/process for control of suspect/counterfeit items (S/CI), and has submitted or will submit material pedigree records as a deliverable product.



NEUP QA Requirements Cont.

- Training and Personnel Qualification
 - Personnel performing research activities have been trained per university documented requirements to ensure work is being conducted properly to prevent rework or the production of unacceptable data.
 - The university has documented the training of personnel performing research activities and has submitted or will submit personnel training records as a deliverable product.



NEUP QA Requirements Cont.

- Analysis/Modeling Software Verification and Validation
 - Software used for modeling development in support of scoping work has configuration control implemented by a minimum of a baselined copy of software executable file plus a text statement describing chronological changes being made. At a minimum, all changes have been verified to operate correctly by the developer and an independent qualified checker prior to use.



NEUP QA Requirements Cont.

- Analysis/Modeling Software Verification and Validation
 - Reports or work summaries for modeling software development include:
 - The software name
 - Version number
 - Computer manufacturer name and model
 - Name and version of operating system
 - A list of libraries or interfaces/environment required for correct software operation.
 - Reference to the applicable V&V documentation
 - Modeling has been performed using codes and/or software packages that have received verification and validation (V&V) in accordance with university documented procedures/processes or some process.



NEUP QA Requirements Cont.

- Analysis/Modeling Software Verification and Validation
 - The code or software version(s) used to develop results has been identified in the project's final report/documentation.
 - Where codes or models have not received V&V, or the V&V documentation is not available, the university has provide a description of the model or code and the tools and methods used to ensure accuracy of the data generated. The data generated has been identified as To Be Verified (TBV) and its use is being tracked until the codes or models have been V&V'd.



NEUP QA Requirements Cont.

- Records
 - Research notebooks/journals of the researchers have been controlled in accordance with university documented procedure/processes.
 - Research notebooks/journals of the researchers have been controlled documents and copies of critical pages have been maintained or access-controlled filing is instituted when not in use to preserve process repeatability and the QA record.
 - Electronic media used to record data and has been subject to documented administrative controls for handling and storage of data.



NEUP QA Requirements Cont.

- Records
 - Work activity records have been maintained by the university and have been provided to the funding organization within 60 days of completion of work scope.
 - The process for development of intellectual property documentation has been controlled under university document control procedures/processes.



NEUP QA Requirements Cont.

- Data Acquisition/Collection and Analysis is
 - When gathering data, the researcher has ensured that the systems and subsystems of the experiment are operating properly.
 - Software systems used to collect data and operate the experiment has received verification that it meets functional requirements prior to collection of actual data.



NEUP QA Requirements Cont.

- Data Acquisition/Collection and Analysis
 - Data anomalies have been investigated and documented.
 - When performing data analysis, the following have been defined and documented:
 - assumptions and the methods used
 - the results obtained /documented so that independent qualified experts can evaluate how data was interpreted
 - methods used to identify and minimize measurement uncertainty;
 - the analytical models used
 - whether the R&D results have been documented adequately and can be validated

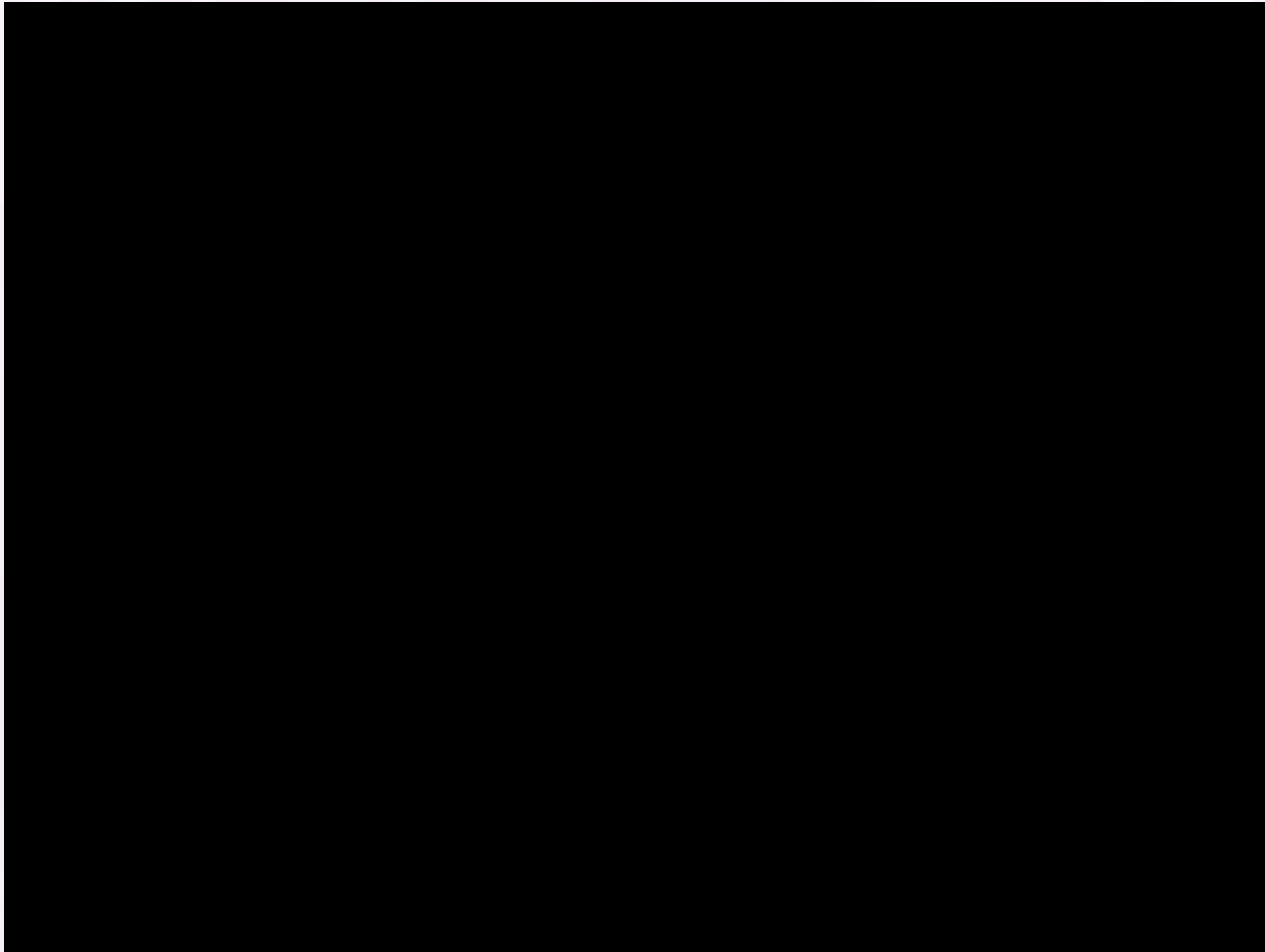


NEUP QA Requirements Cont.

- Peer Review
 - Peer reviews have been performed in accordance with journal peer review requirements.
 - The peer reviews have been documented and maintained by the university.
 - Peer review documentation and results have been or will be provided to the funding organization if requested.



Open Communication is Essential to Our Success





**QUALITY
ASSURANCE
AND THE
SINKING OF
THE
LARGEST
OFFSHORE
OIL
PLATFORM**

March 2001



**For those of you who
may be involved in
project cost control (at
whatever level),**



**please read this quote from
a Petrobras executive,**



**extolling the benefits of
cutting quality assurance
and inspection costs,**



on the project that
sunk into the Atlantic
Ocean off the coast of
Brazil in March 2001.





"Petrobras has established new global benchmarks for the generation of exceptional shareholder wealth"



through an aggressive and innovative programme of cost cutting on its P36 production facility.

Conventional constraints have been successfully challenged



and replaced with new paradigms appropriate to the globalized corporate market place.





**Through an integrated network
of facilitated workshops,**

the project successfully rejected the established constricting and negative influences of prescriptive engineering,



**onerous quality requirements, and
outdated concepts of inspection
and client control.**





Elimination of these unnecessary straitjackets has empowered the project's suppliers and contractors to propose highly economical solutions,





with the win-win bonus of enhanced
profitability margins for themselves.



The P36 platform shows the shape of things to come