

# MSHA's Review of Seal Plans

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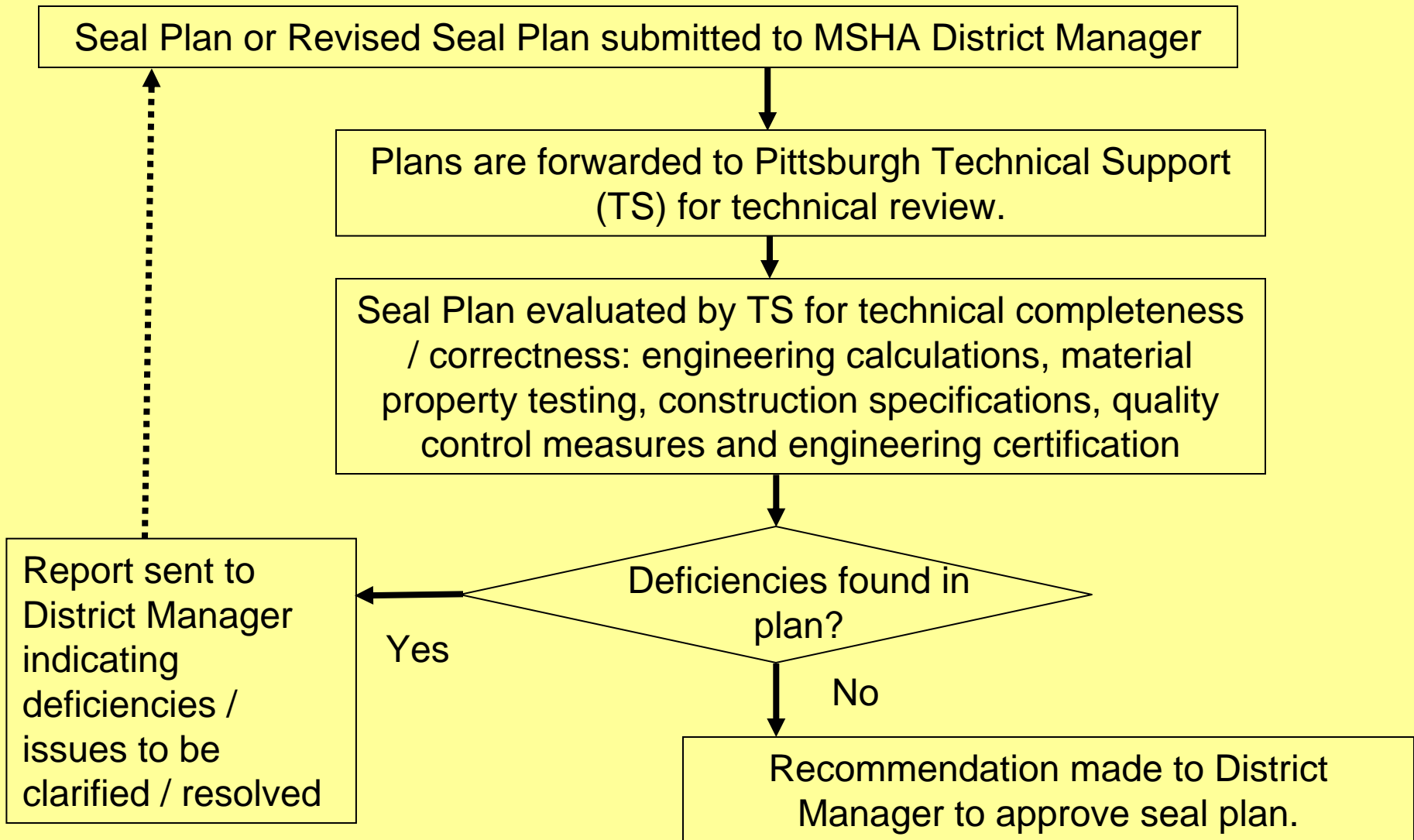
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# The Seal Plan Review Process...



## Please Note:

- Technical Support does not have the authority to “approve” seal plans.
- Seal plans can only be approved by the District Manager.
- There are no “blanket” approvals for an alternative seal design – a plan specific to the conditions at each mine must be submitted to the District for review by TS and ***approval by the District Manager.***

# “Provisional Approvals”

- TS has recommended “provisional” approvals to give seal manufacturers or mine operators time to complete more detailed testing for engineering properties and more rigorous engineering analyses.
- Necessary to allow seals to be constructed – especially in situations prone to spontaneous combustion.
- Such approvals are only recommended when TS considers there to be sufficient evidence that the proposed seal will be adequate.
- The condition of approval is that when the additional testing / analyses are performed, if the results indicate that the seals need to be strengthened, then the mine operator will take steps to strengthen the seals.
- To date, TS has recommended “approval” of a Precision Mine Repair reinforced concrete seal, and “provisional approval” of several Minova Tekseal seals...

## TS Seal-Plan Review Personnel

- Terence Taylor, PE. Senior Civil Engineer, BS Structural Engr. Penn State; Masters Degree – Structural Engineering, U. of Colorado
- Richard Allwes, PE. Civil Engineer, BS Mining – U. of Pittsburgh Masters – Structural Engineering - Carnegie Mellon; 10 years Structural Design Section, COE; training in the design of blast resistant structures.
- Darren Blank, PE. Civil Engineer, BS w Structures Emphasis; Masters Degree – Geotechnical Engineering, U. of Pittsburgh
- Carol Tasillo, PE. Civil Engineer, BS - Structures and Geotechnical, U. of Pittsburgh; Masters in Materials from Purdue; (with emphasis on concrete & cement based materials)
- Michael Superfesky, PE. CE, Masters - Structural Engineering WVU Masters – Geotechnical Engineering Pittsburgh

# Information on Submitted Seal Plans...

(As of 2-20-2007)

- No. of seal plan submittals 92
- No. of seal plan reviews 54
- Backlog of seal plans 38
  
- No. of mines with seal plan submittals 47
  
- No. full approvals recommended 1
- No. provisional approvals recommended 10

# Seal Manufacturers Represented...

- **Minova**
  - Tekseal plug-type seal (Several Provisional approvals...)
- **Micon**
  - Polyurethane/gravel/steel seal (Under review...)
- **Strata Products**
  - “Pre-loaded” grout bags with wood (Under review...)
  - “Pre-loaded” grout bags w conc. block
- **Precision Mine Repair**
  - Reinforced concrete seal (Approval recommended at Highland Mine)
- **R.G. Johnson**
  - Celuseal core between two 3-inch thick reinforced walls (Under review...)

# Review Problems...

- We've gone from virtually no engineering to a high level of engineering.
- In the previous pass/fail testing of seals, material properties – tensile, bending, shear, etc. were not required...
- Interaction with mine strata not previously evaluated on a mine specific basis.



So that construction and QC requirements are clear to everyone...

- Need a final set of construction specifications and quality control measures that include all revisions that are made during the review process...
- These should be in a separate section of the plan...

# How do we know a seal will withstand X psi?

- **Full-Scale Seal Testing**

- Preferred method...
- Especially for unusual materials or materials not previously tested...
- Validate / calibrate numerical models...

- **Issues**

- Shape and duration of pressure pulse;
- Factor of Safety...
- Simulation of coal mine anchorage or interface conditions;
- Quality Control...

- **Engineering Analysis**

- Best use is to extend the results of full scale testing to other situations.
- Needs to be conservative...

- **Issues**

- Material properties...
- Pressure/time history relationship to apply...
- Level of sophistication of analysis...

Recommended reference on the design of seals for blast loading:

**"Structures to Resist the Effects of Accidental Explosions,"**

**TM 5 - 1300**

**November 1990.**

This manual establishes design procedures and construction techniques whereby propagation of explosion (from one structure or part of a structure to another) can be prevented, and to provide protection for personnel and equipment.

This manual can be downloaded from this web site:

<http://www.ddesb.pentagon.mil/tm51300.htm>

ARMY TM 5-1300  
NAVY NAVFAC P-397  
AIR FORCE AFR 88-22

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**STRUCTURES TO RESIST**  
**THE EFFECTS OF ACCIDENTAL**  
**EXPLOSIONS**

"Approved for public release; distribution is unlimited"

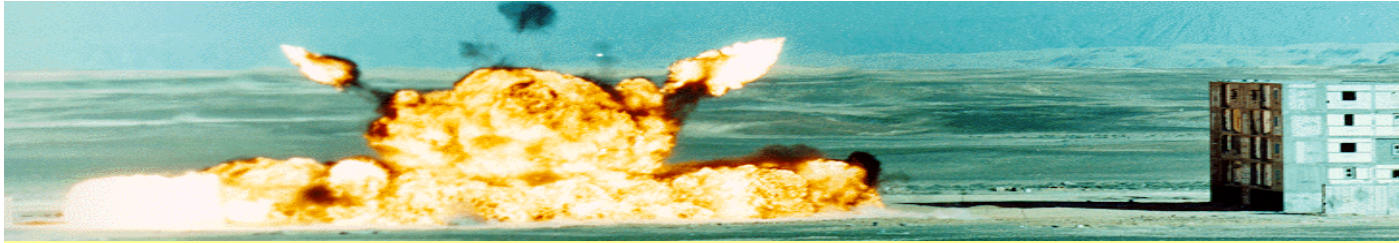
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DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE  
NOVEMBER 1990

# “Structures to Resist the Effects of Accidental Explosions”

- Topics:
  - Blast, Fragment and Shock Loads
  - Principles of Dynamic Analyses
  - Reinforced Concrete Design
  - Structural Steel Design
  - Design Criteria for Reinforced Masonry Walls
  - Non-reinforced Masonry Walls

Manual is 1800 pages long...



## Blast Mitigation Action Group (BMAG)

[https://bmag.usace.army.mil/consulting\\_firms.php](https://bmag.usace.army.mil/consulting_firms.php)

### List of Blast Consulting Firms

- [ABS Consulting](#)
- [ACTA, Inc.](#)
- [ARUP](#)
- [Ammann and Whitney](#)
- [Applied Research Associates](#)
- [Baker Engineering and Risk Consultants, Inc.](#)
- [CBM Engineers, Inc.](#)
- [CTI Consulting](#)
- [Carter & Burgess, Inc.](#)
- [DMJM H&N](#)
- [Energetic Materials Research and Testing Center](#)
- [Hinman Consulting Engineers, Inc.](#)
- [KPFF Consulting Engineers](#)
- [Karagosian and Case Structural Engineers](#)
- [Kiger Consulting Engineering](#)
- [Mason and Hanger Group](#)
- [Protective Technology Center](#)
- [Science Applications International Corporation](#)
- [Simpson Gumpertz & Heger Inc.](#)
- [Southwest Research Institute](#)
- [Thornton-Tomasetti Group](#)
- [Weidlinger Associates, Inc.](#)
- [ZACE Consulting Engineers](#)

# What we (TS) need to do...

- Process submitted seal plans faster...
- Add engineering staff who will be devoted to seal work.
- Attempt to arrive at agreements with seal manufacturers on basic seal designs that will satisfy the 50 psi overpressure requirement. (However, mine operators will still need to submit seal plans providing specific information on their mine conditions and demonstrating that the “basic” seal design is applicable to their conditions.)
- Promote full-scale seal testing to verify / calibrate engineering analyses...

# What you can do...

- Consult with designers experienced with designing structures for blast loads.
- Provide complete engineering analysis to document that the proposed seal design will “reliably withstand” an overpressure of at least 50 psi – considering all potential failure modes.
  - Use applicable design manuals and codes (e.g., ACI 318, TM 5-1300)
  - Provide substantiation for engineering properties used in the design.
  - Provide specific information about the mine, including:
    - Ventilation map showing seal locations and seam contours;
    - Height and width of mine entries to be sealed;
    - Water and convergence conditions;
    - Geologic features and pertinent engineering properties on roof, floor and ribs.
- Prepare a section of the plan providing final detailed construction specifications for the seals.
- Provide details on the quality control supervision and testing to be performed during seal construction to ensure compliance with plan;
- Provide a certification by a PE of the seal plan – for use in the specific mining conditions
- Support full-scale seal testing done to verify / calibrate engineering models...