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Overview and Analysis of Historical Steam Generator Degradation Mechanisms

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Overview of EPRI
Steam Generator Management Program

Overview of EPRI Steam Generator Management Program

- EPRI was established in 1973 as an independent, nonprofit organization to manage a broad public-private collaborative to conduct research on key issues facing the electric power industry on behalf of its members, energy stakeholders, and society.
- In 1975 EPRI established a steam generator program to proactively address and resolve existing and emerging steam generator-related issues on a consistent, industry-wide basis.
- The SGMP develops guidance and technological tools to effectively manage steam generator tube degradation, ensure steam generator tube integrity and operability, and reduce maintenance and operating costs associated with steam generators.

Overview of EPRI Steam Generator Management Program

The specific objectives of the EPRI SGMP include:

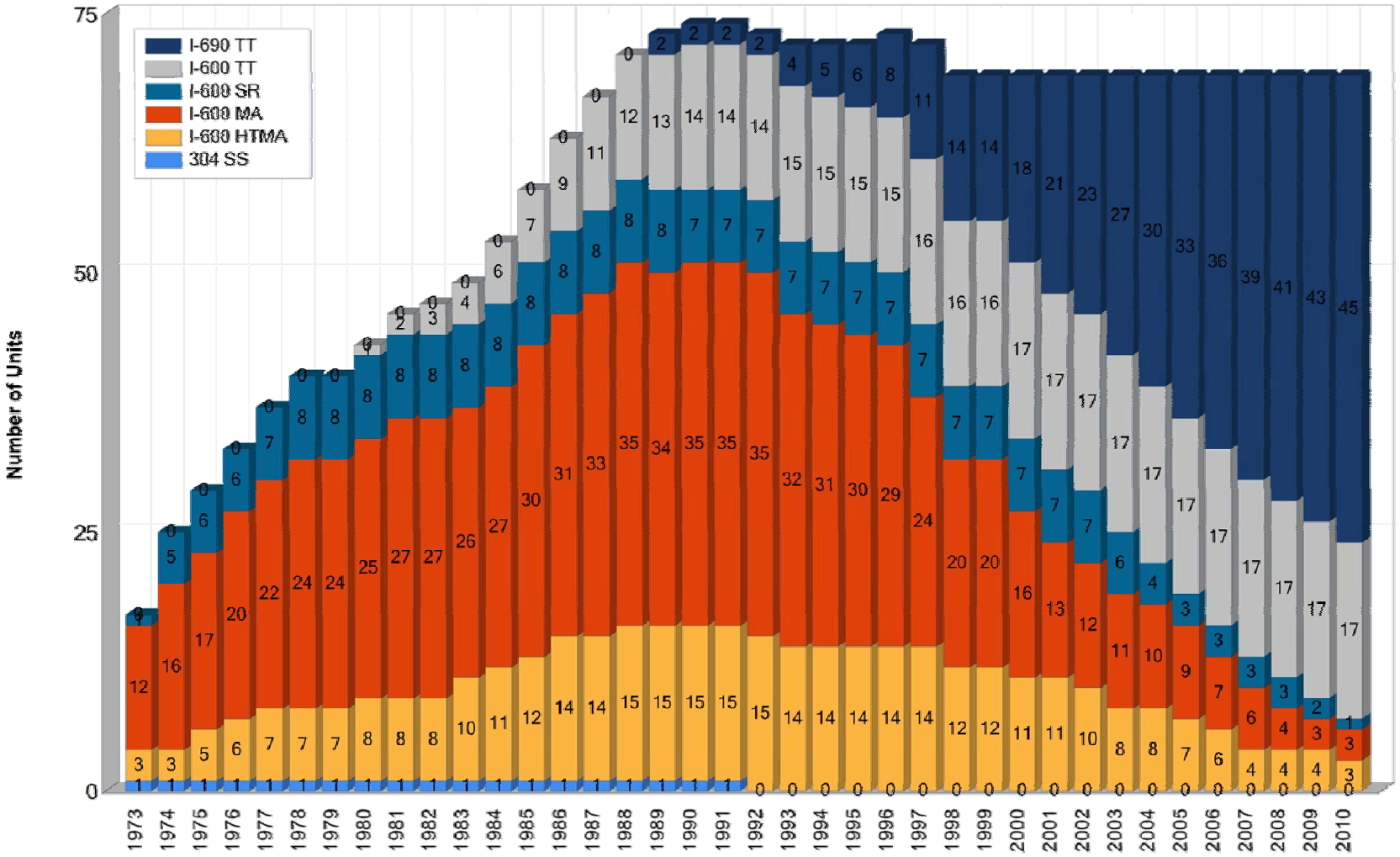
- Identifying, prioritizing and conducting steam generator research to address knowledge gaps as defined in the EPRI Materials Degradation Matrix Issue Management Tables
- Performing long term R&D in areas such as water chemistry, NDE, materials and thermal hydraulics that have significant impact on steam generator operational issues.
- Developing necessary technology, processes, procedures, and tools to support the assessment of steam generator tube integrity.

Overview of EPRI Steam Generator Management Program

- The EPRI SGMP develops guidelines and other technical documents to maintain safe and reliable steam generator operation
- The EPRI Guidelines that form the basis of steam generator program requirements are:
  - *PWR Secondary Water Chemistry Guidelines*
  - *PWR Primary Water Chemistry Guidelines*
  - *PWR Steam Generator Examination Guidelines*
  - *PWR Primary-to-Secondary Leak Guidelines*
  - *Steam Generator Integrity Assessment Guidelines*
  - *Steam Generator In Situ Pressure Test Guidelines*

Overview and Analysis of Historical Steam Generator Degradation Mechanisms

Tube Material by Year for Operating Steam Generators (US Plants)



Plot is based on data in SGDD.

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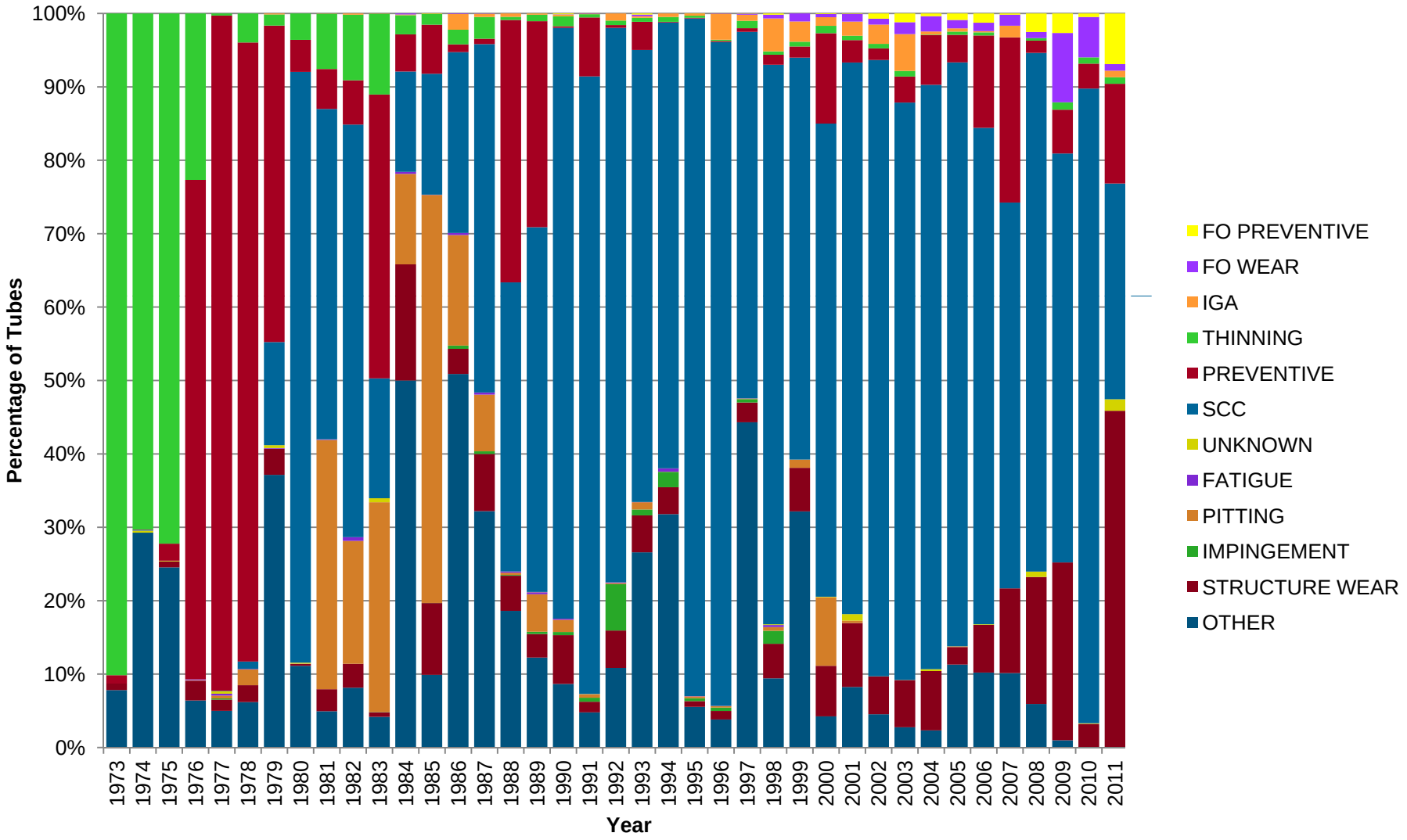
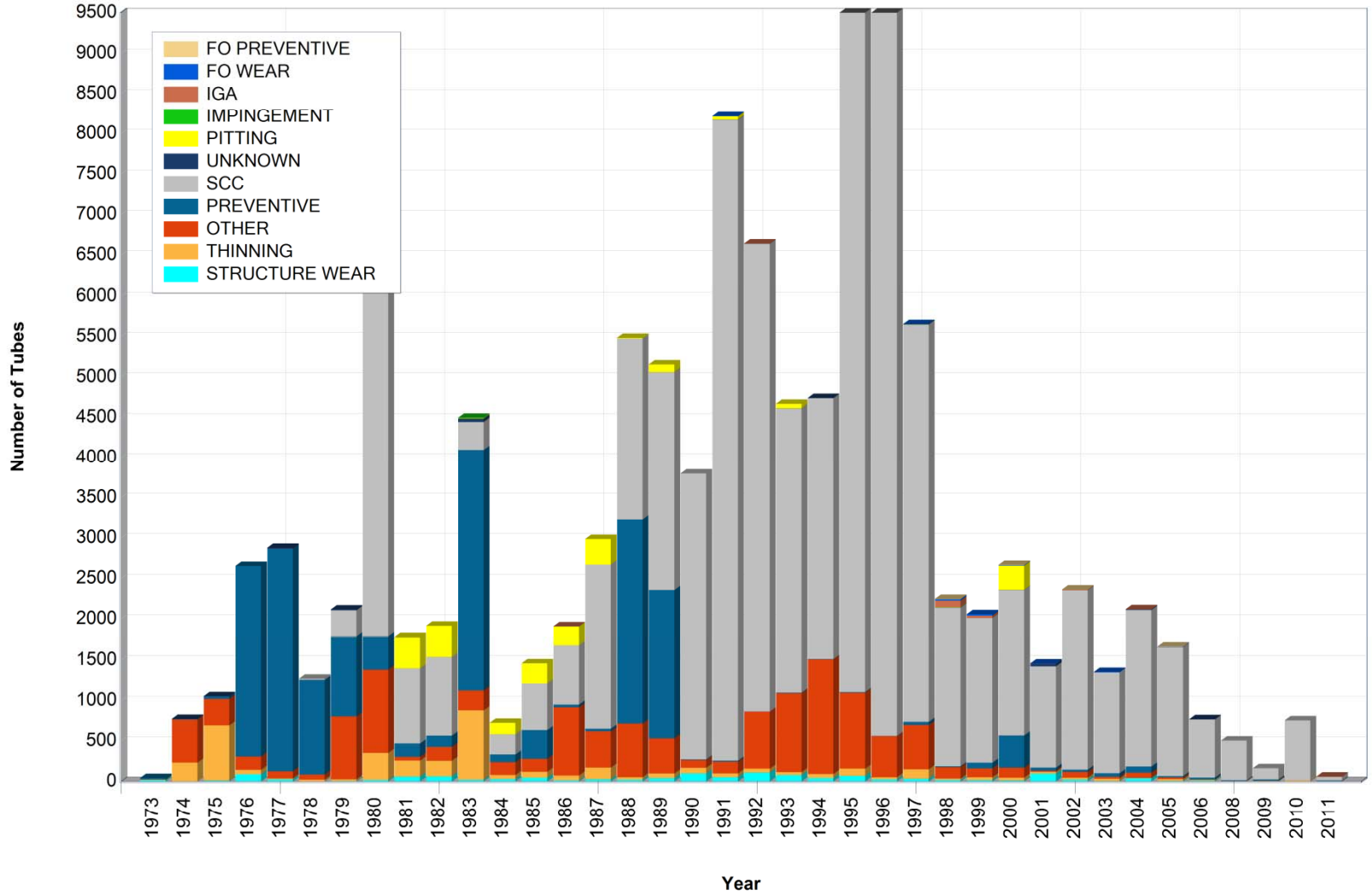
Causes of Steam Generator Tube Repair
(US Plants)



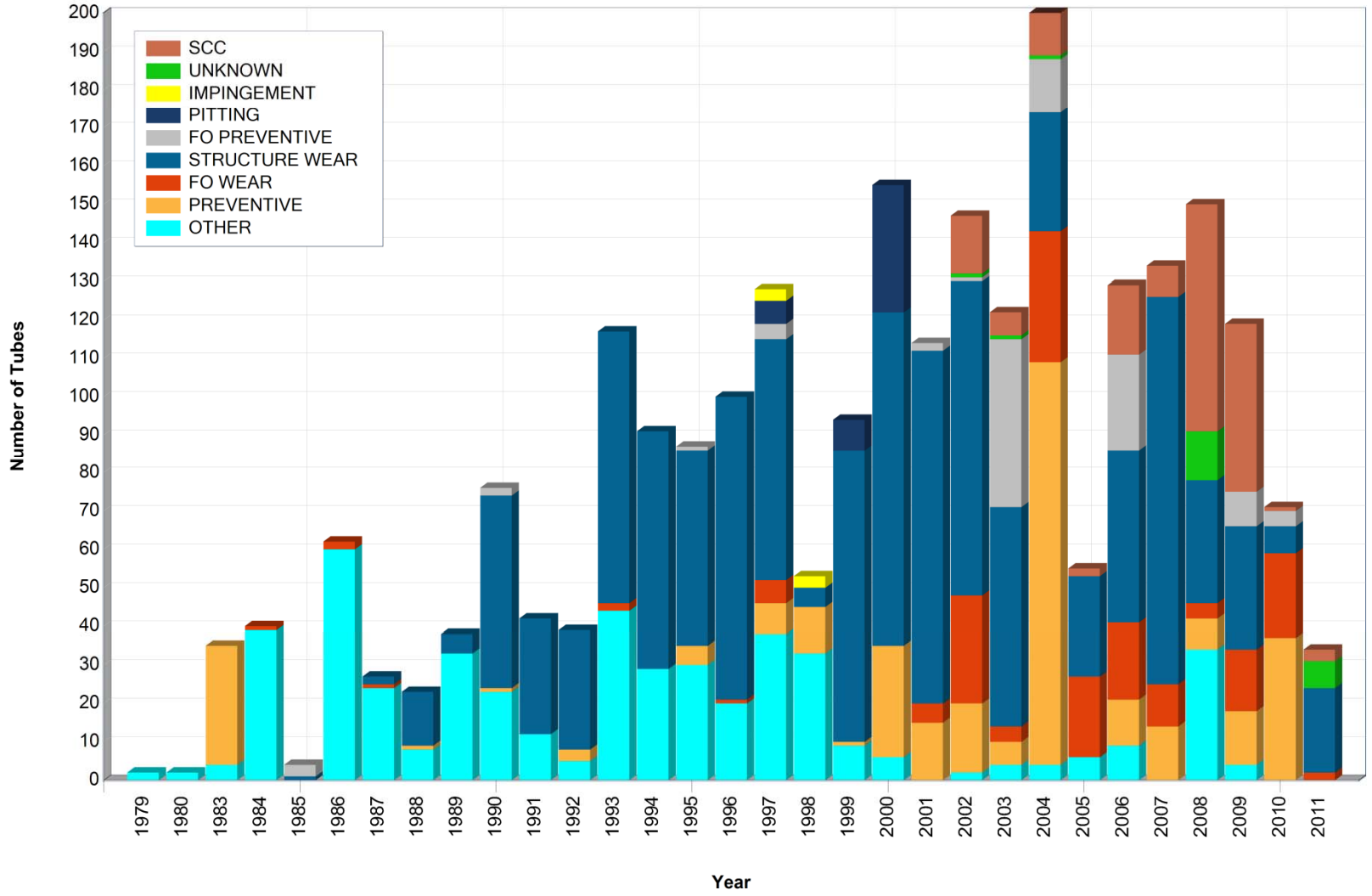
Plot is based on data in SGDD

US Steam Generators (Alloy 600 MA)
Number of Tubes Repaired



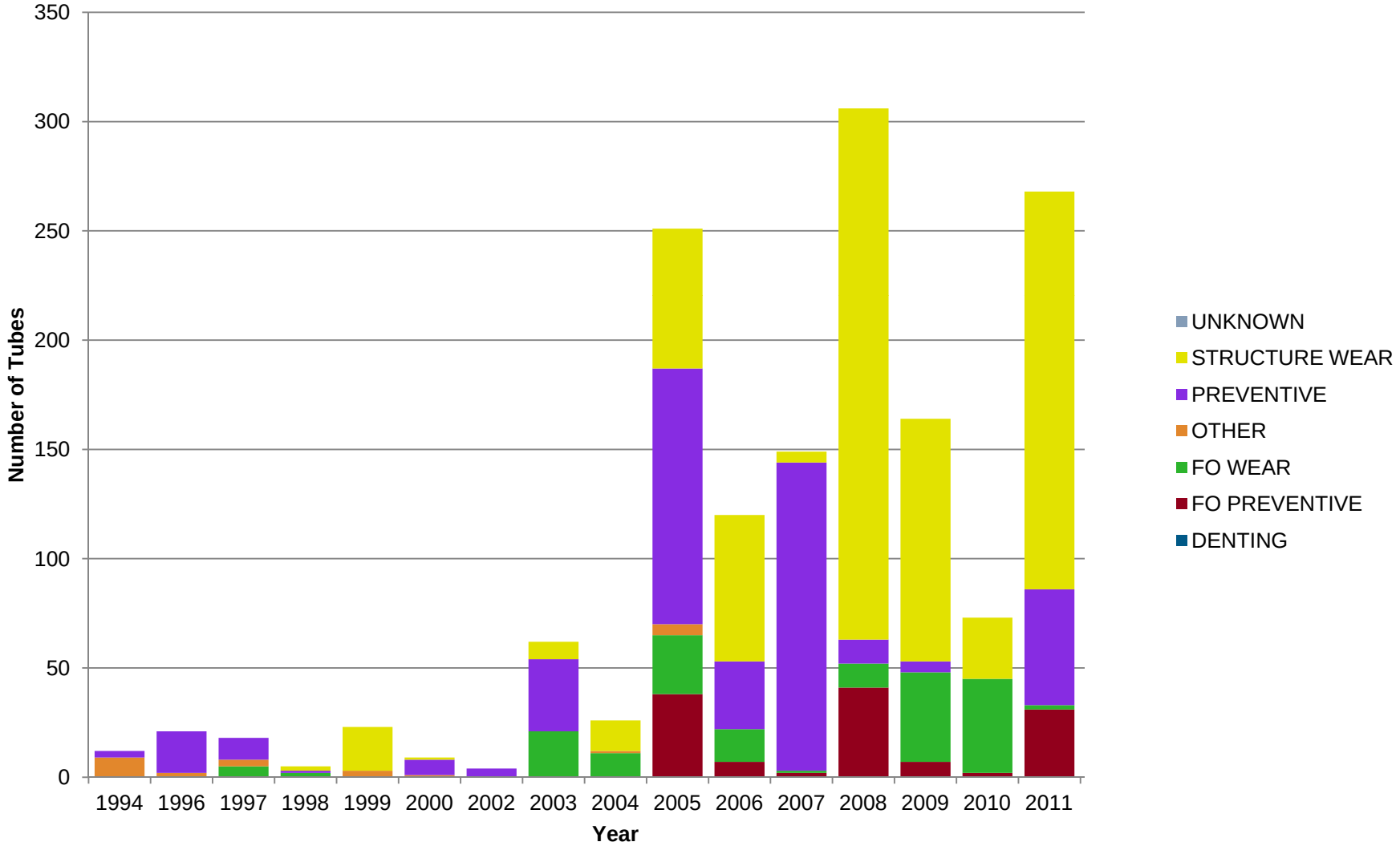
Plot is based on data in SGDD.

US Steam Generators (Alloy 600TT)
Number of Tubes Repaired



Plot is based on data in SGDD.

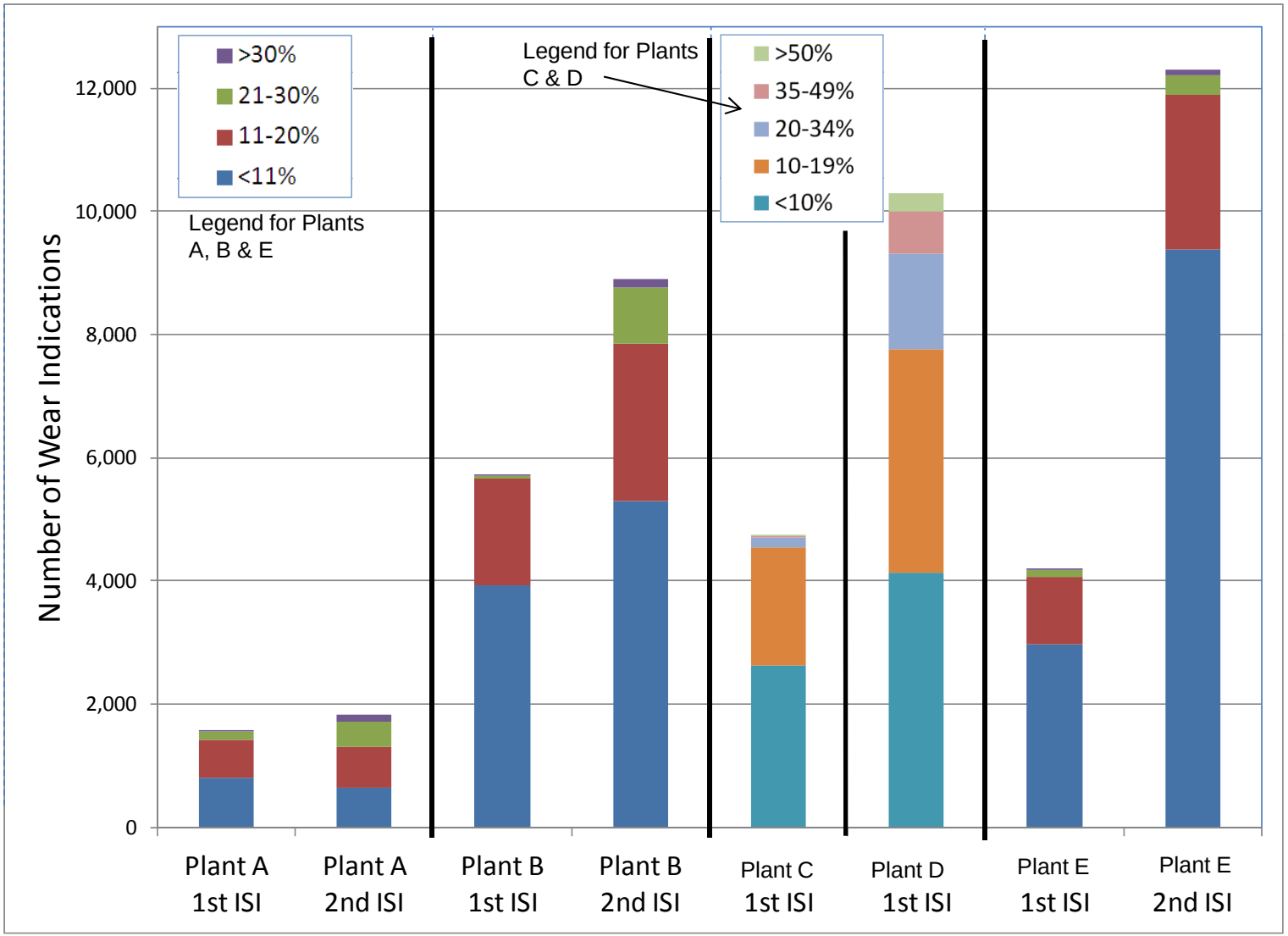
US Steam Generators (Alloy 690TT)
Number of Tubes Repaired



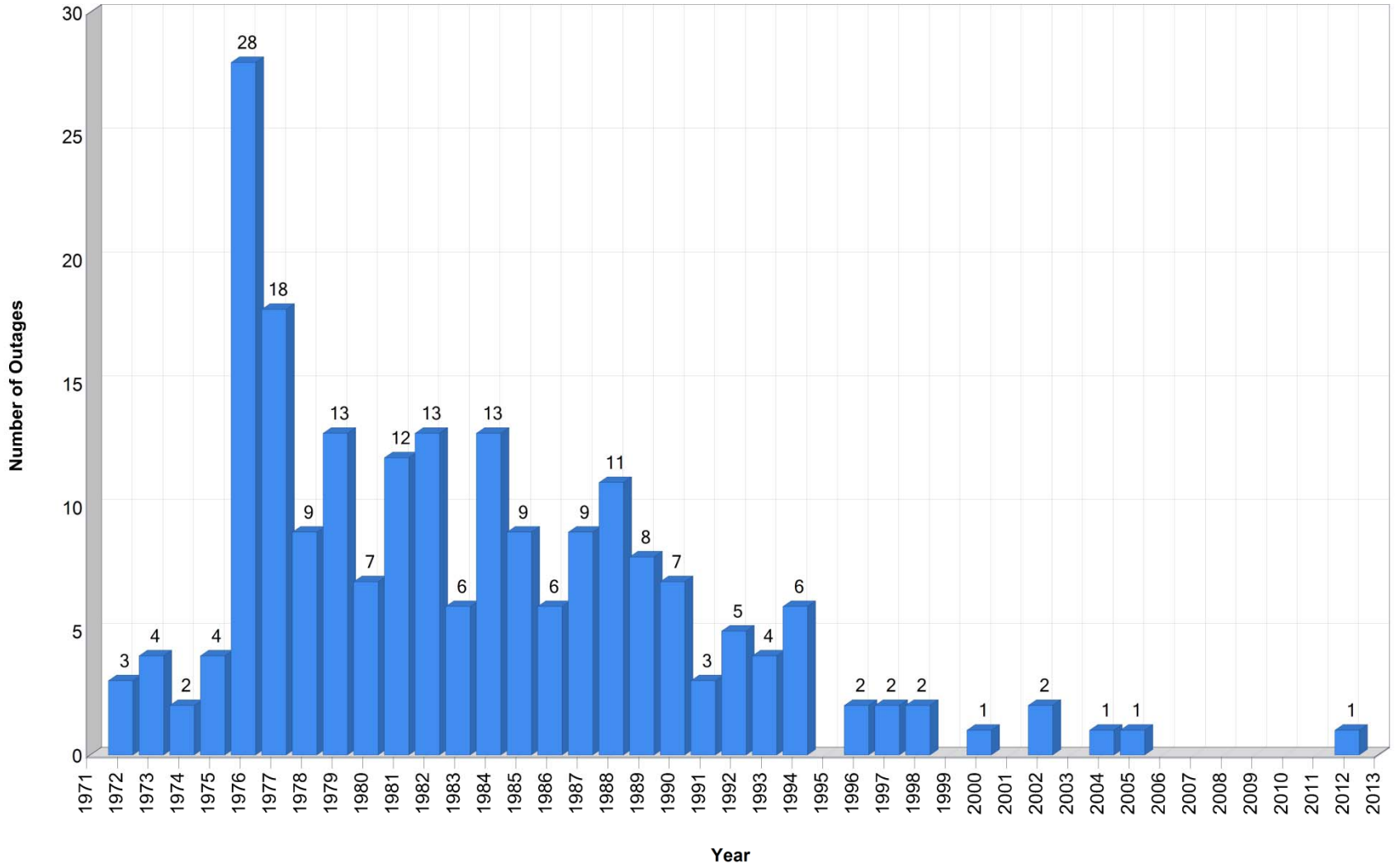
Plot is based on data in SGDD

Wear Indications in Replacement SGs

Top 3 units with 2 ISI's, Top 2 units with 1 ISI



SG Tube Leak Forced Outages (US)



Plot is based on data in SGDD.

Conclusions

- SGMP provides the tools to develop technically strong steam generator programs which focus on maintaining SG tube integrity.
- The tools include results of EPRI research, guidance documents and access to world-wide SG operating experience.
- SG programs are continuously updated based on new industry guidance, research results and industry operating experience.
  - For example, industry guidance has been flexible enough to address emerging tube degradation issues ranging from SCC to foreign object wear to tube-to-tube wear.

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