

Web-based inspections in industrial radiography

Digital inspections in an analogue world



Statens strålevern
Norwegian Radiation Protection Authority

www.nrpa.no

IAEA-TECDOC-1526 (2007)

TABLE 1. SUGGESTED INSPECTION FREQUENCIES

Use	Inspection Frequency (years)
Dental radiography	5
Nuclear medicine	1-2
Radiotherapy	1
Diagnostic radiology – centres with complex equipment (e.g. computed tomography, interventional radiology, fluoroscopy, mammography)	2-3
Diagnostic radiology – centres with conventional X ray equipment only	3-5
Industrial radiography	1
Irradiators (i.e. industrial)	1
Irradiators (i.e. research)	3-5
Radiation gauges	3-5
Well logging	1-3



Industrial radiography in Norway



Solution?



Solution?



Solution?



Method

- Questionnaire sent to radiation protection officers (RPO) by e-mail.
- Unique link in e-mail leads RPOs to their company specific questionnaire online.
- Accompanying letter from NRPA emphasising that responding is obligatory, not voluntary.
- Questionnaire, e-mails, replies handled by EasyResearch™.



Questionnaire

- 52 questions.
- Questions grouped thematically over 8 pages.
- Multiple choice or specific format to enable automated analysis.
- All questions had to be answered to be able to complete questionnaire.

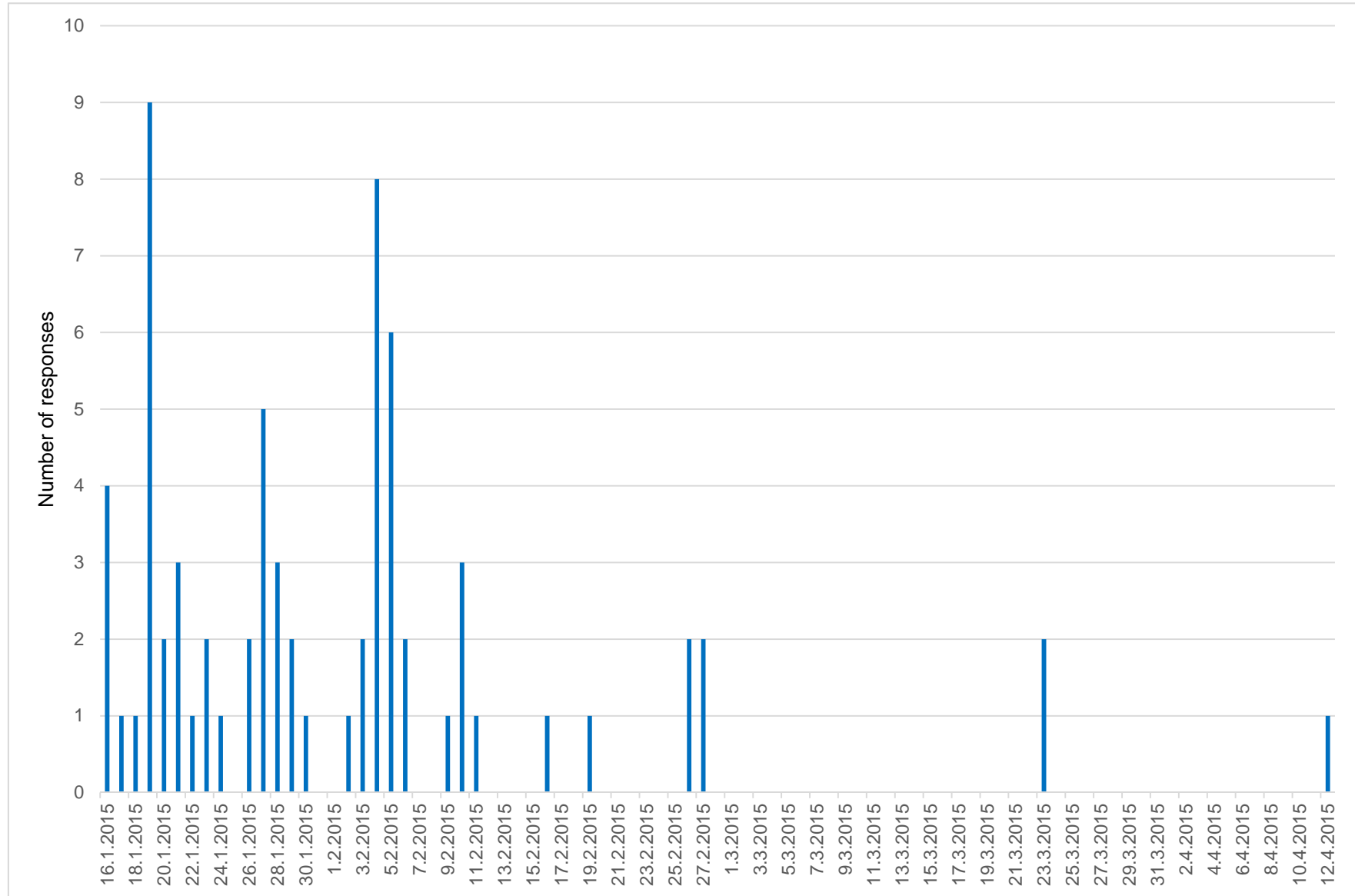


Questionnaire

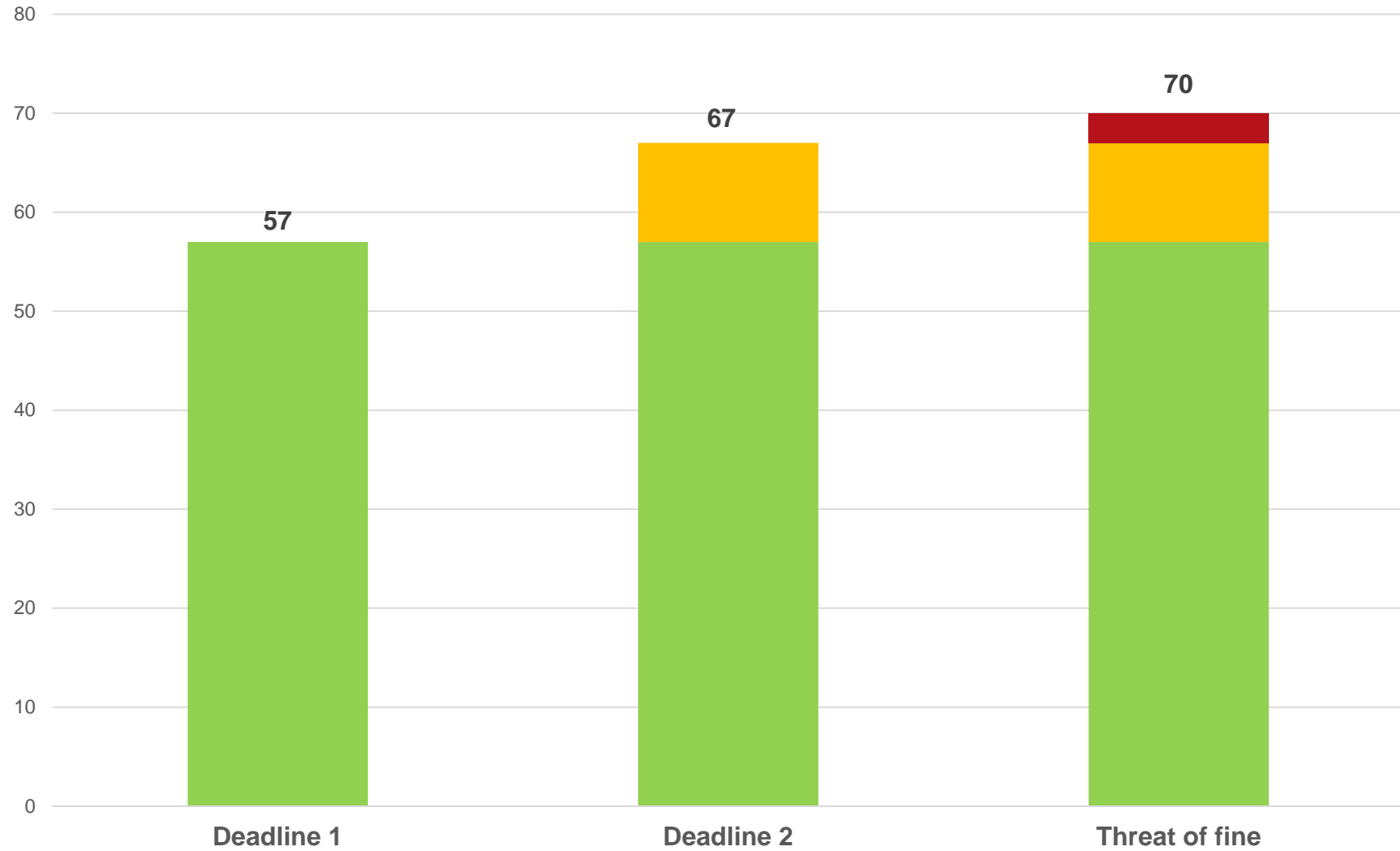
- 8 possible non-compliances.
("Does there exist written instructions for RPO?")
- 9 possible notifications.
("What year were instructions for RPO revised?")
- 22 requests for information.
("Number of devices for gamma radiography?")
- 13 questions regarding substitution.
("To what extent can UT replace gamma/x-ray?")



Response timeline



Response timeline

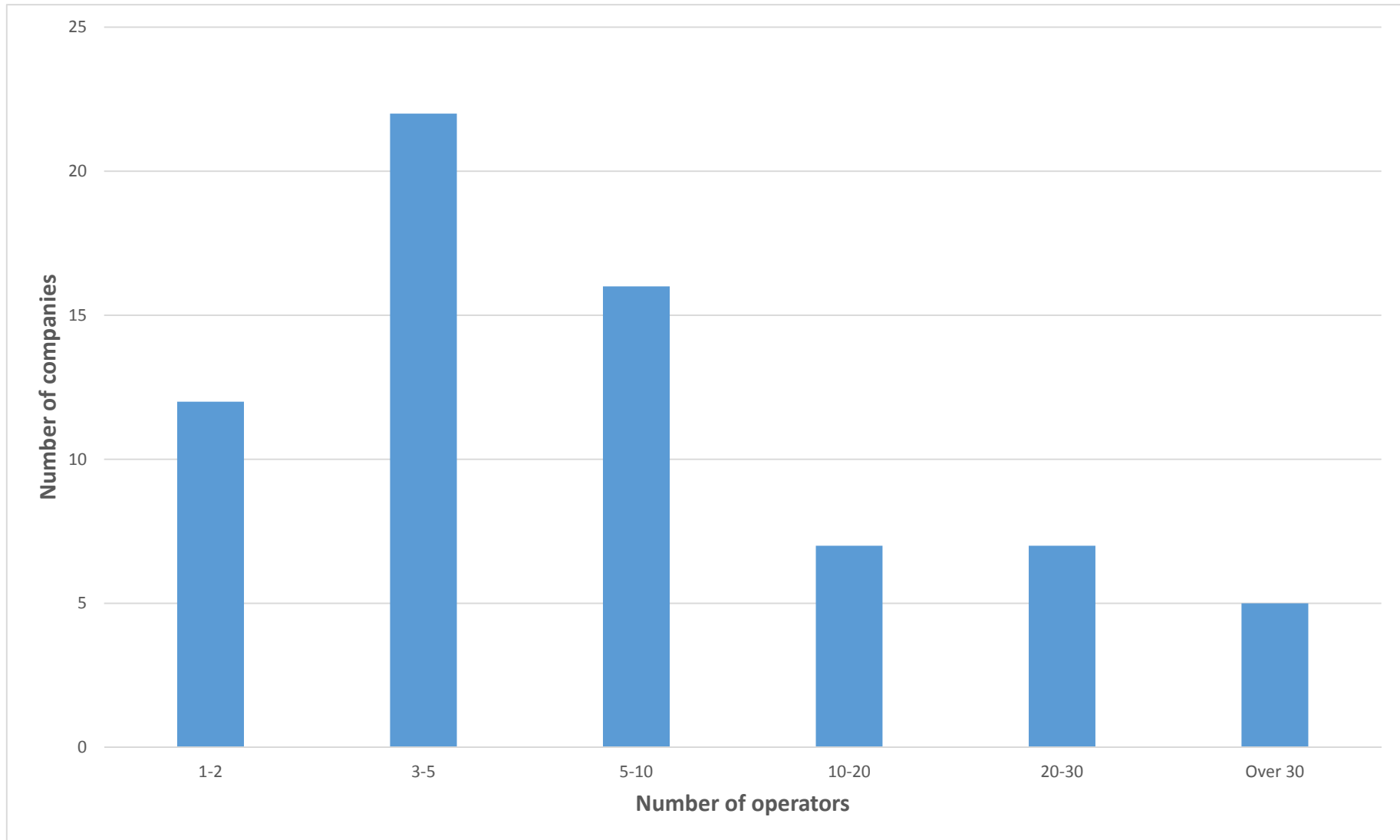


Results – overview

- 70 questionnaires – 70 replies – response rate 100 %.
- Updated information on radiography companies:
 - 928 radiation protection certified operators.
 - 255 gamma sources.
 - 237 x-ray sources.



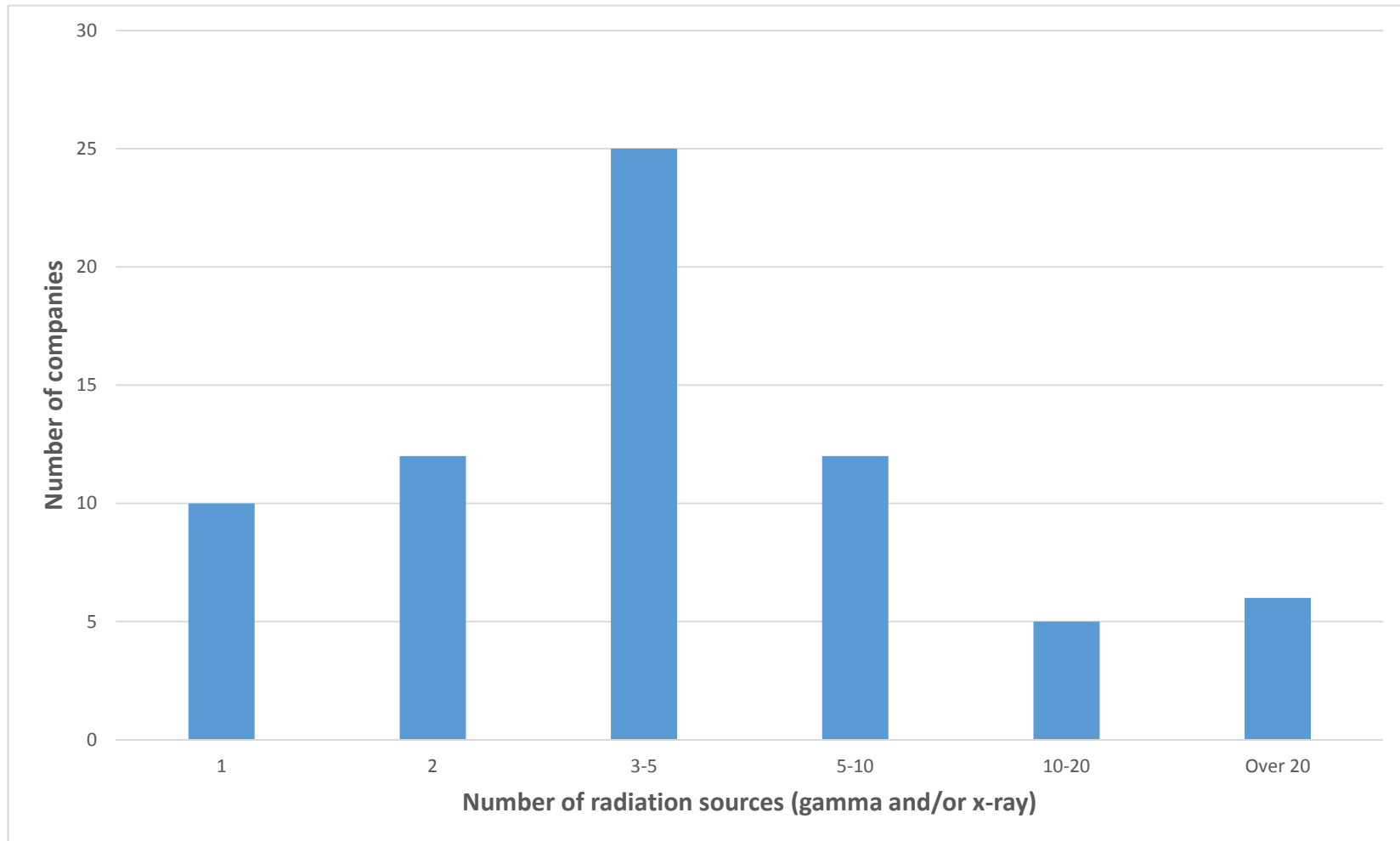
Results - overview



Number of radiography operators is 10 or less for about two thirds of the companies



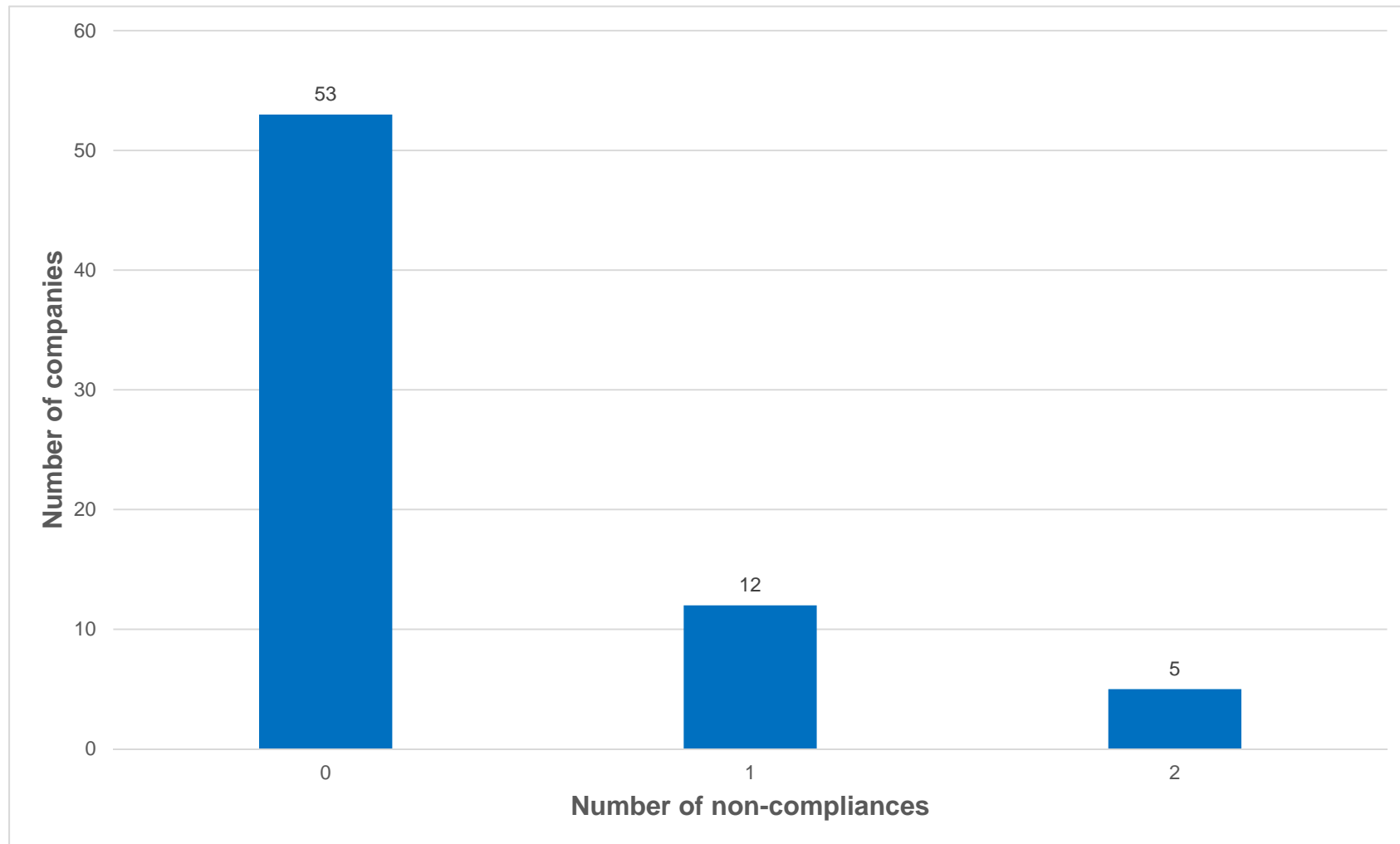
Results - overview



Number of radiation sources is five or less for about two thirds of the companies.



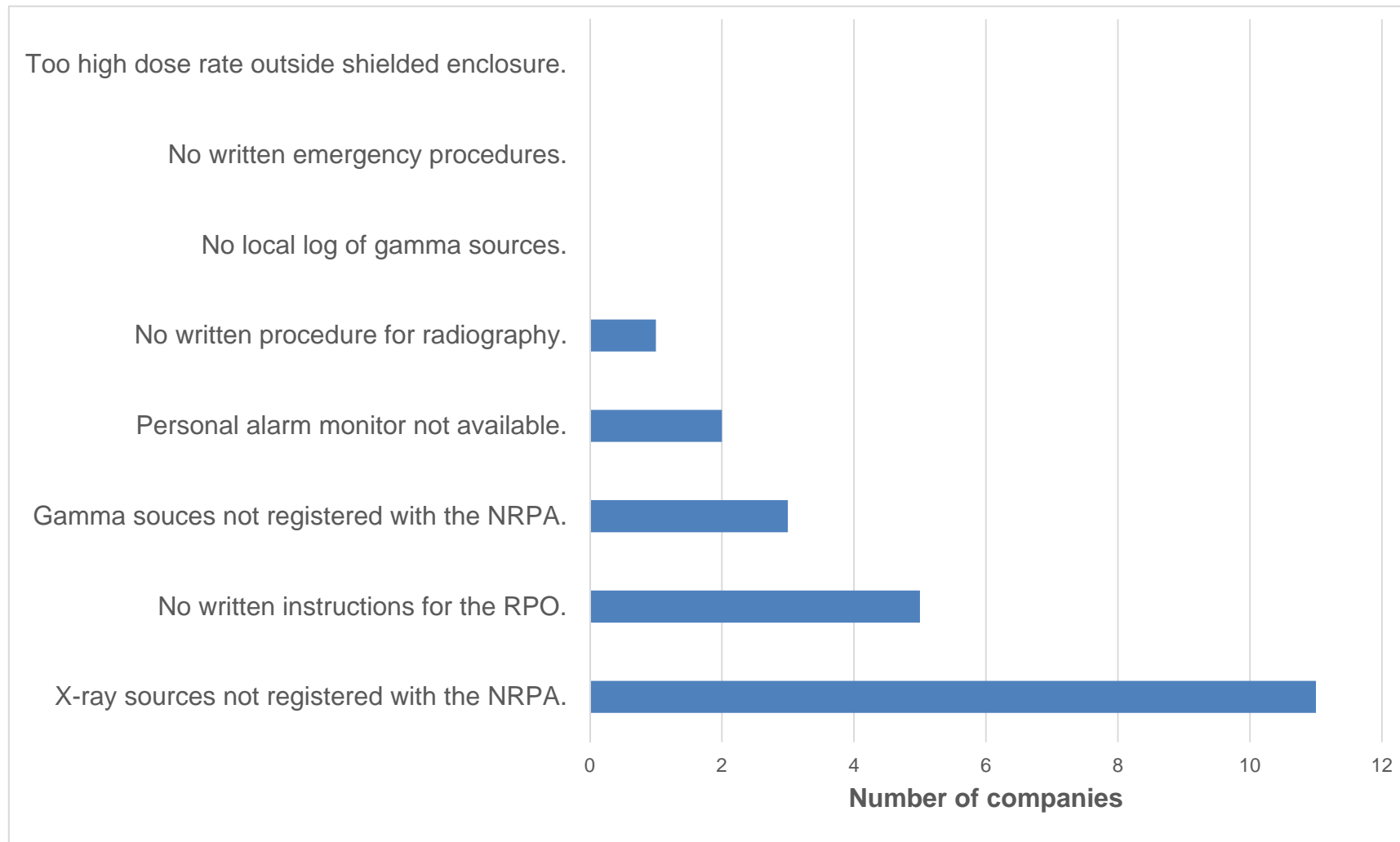
Non-compliances - distribution



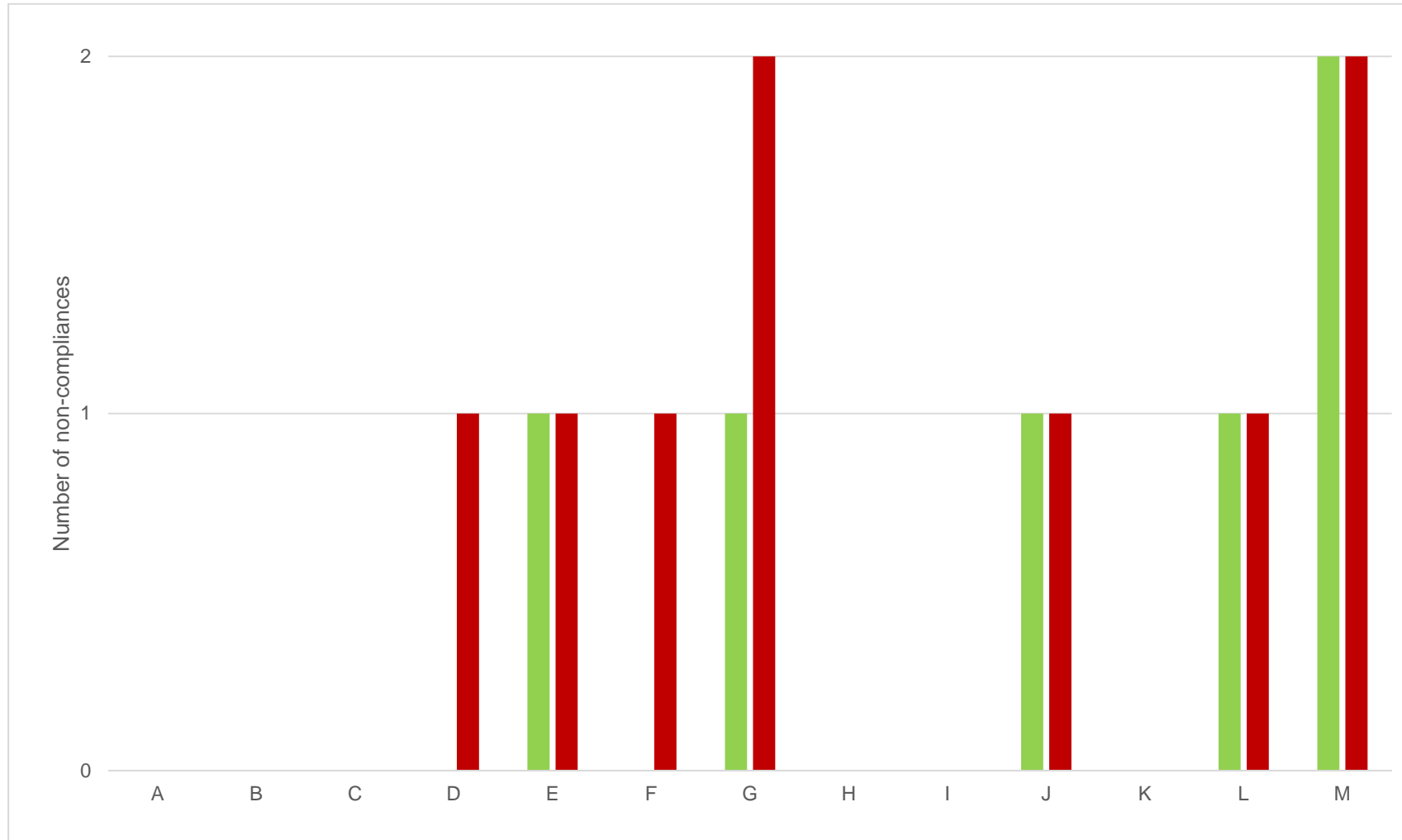
22 non-compliances in 17 radiography companies, none had more than two.



Non-compliances – causes



Web-based vs on-site inspections



13 companies were subjected to on-site inspections in parallel to the web-based ones. More non-compliances were found on-site, unsurprisingly.

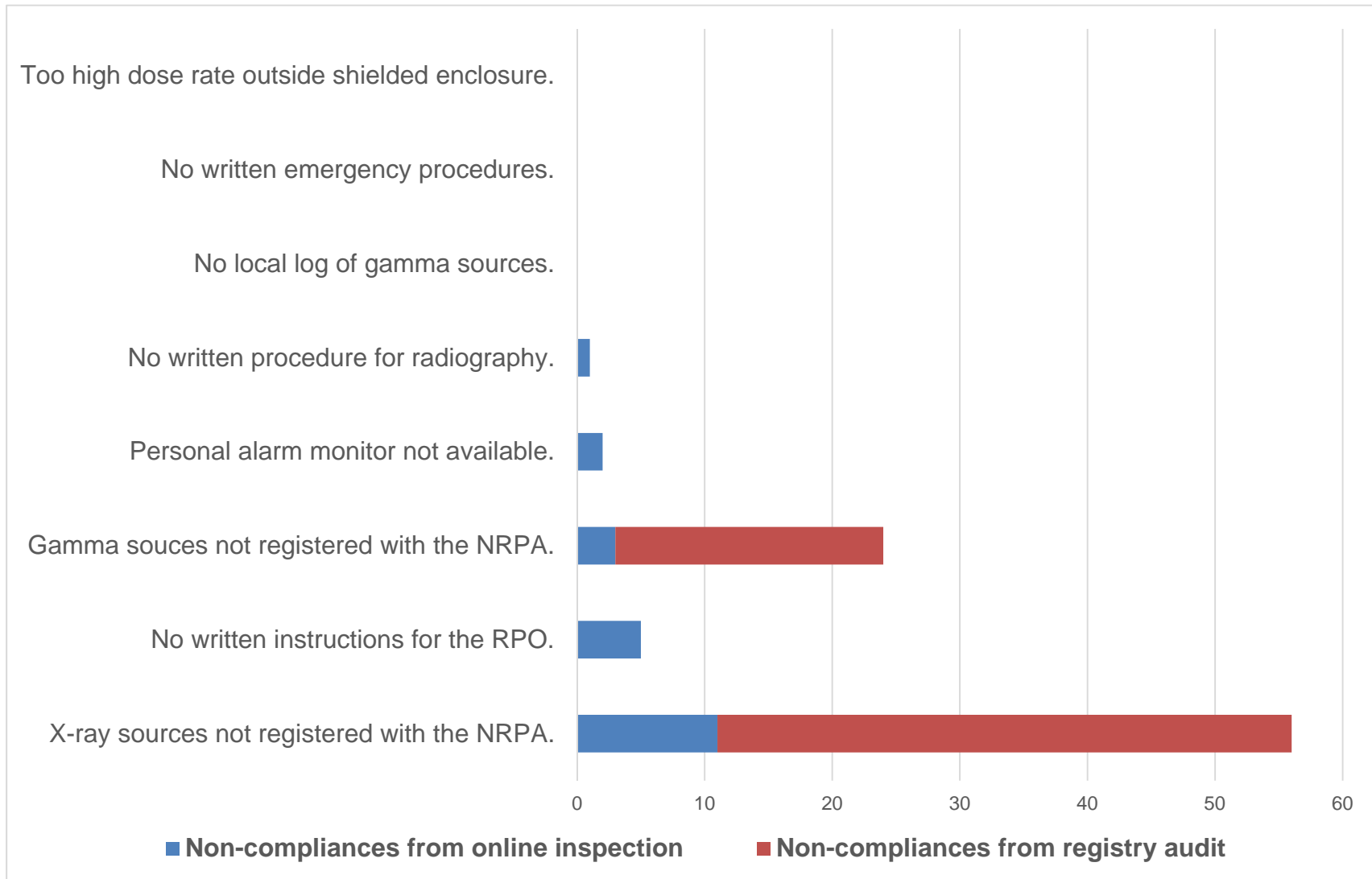


Web-based vs on-site inspections

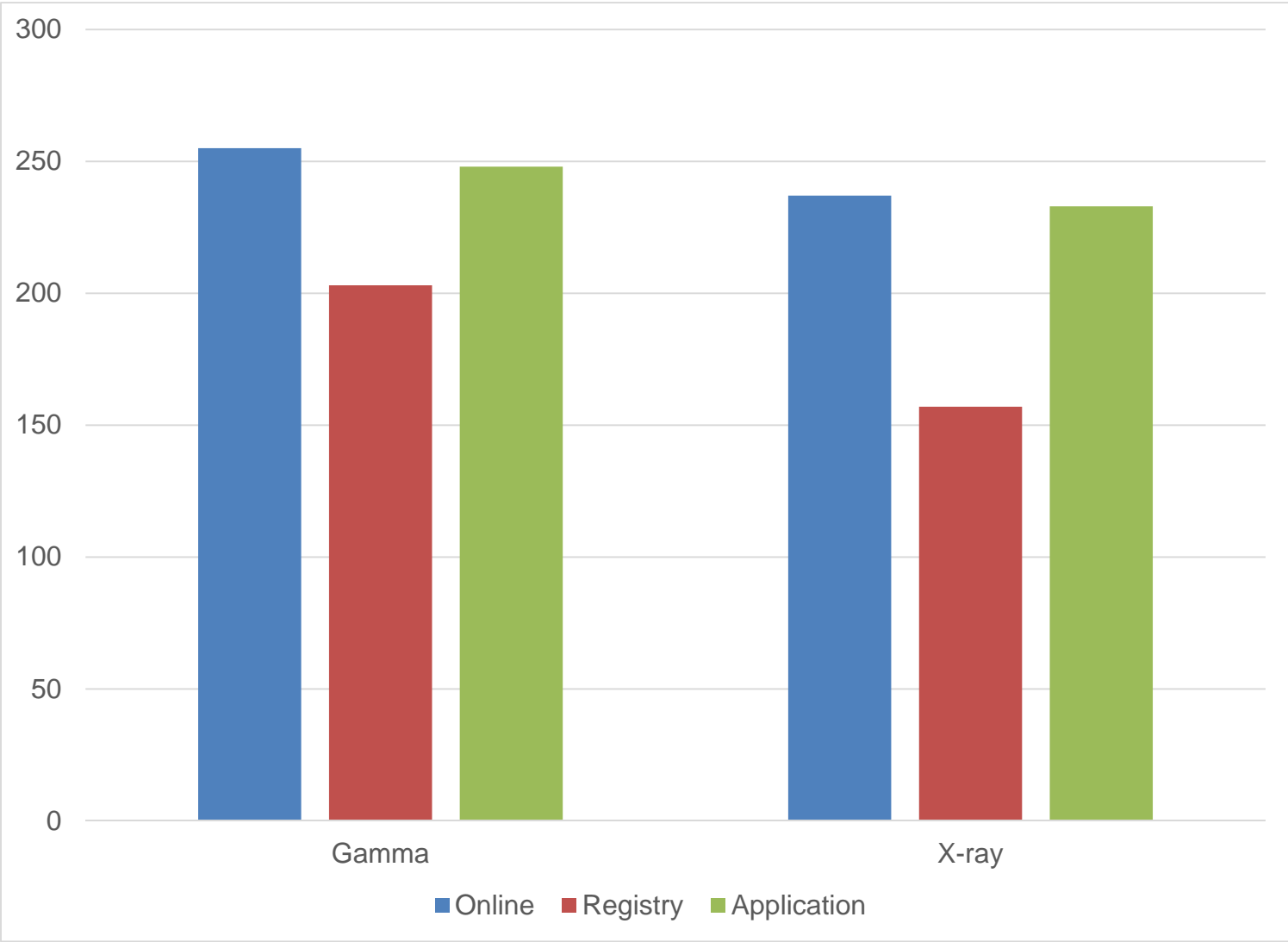
- **Company D.**
In questionnaire, they confirmed having written procedures, thus in compliance. On-site these procedures were found sufficiently poor and outdated to warrant a non-compliance.
- **Company F.**
Said in questionnaire that they were using a closed facility for radiography. On-site inspection revealed that this facility did not fulfill all conditions of a closed facility, and a non-compliance was issued.
- **Company G.**
Gave a number of certified operators in questionnaire. Turned out on on-site inspection that one operator did not possess an accredited certificate in radiation protection.



Self reporting vs NRPA auditing



Self reporting vs NRPA auditing

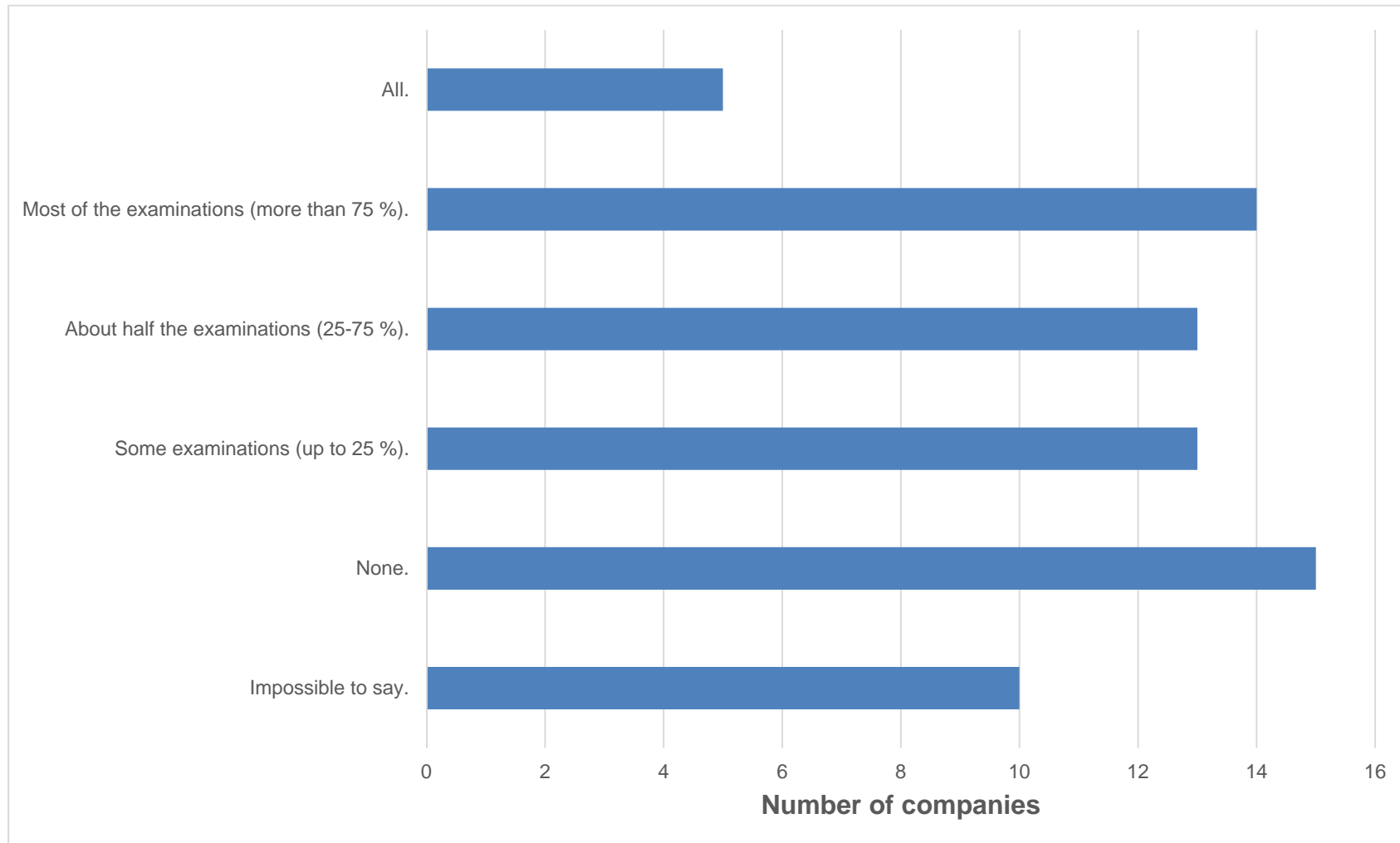


Substitution

- Question: To what extent can gamma and/or x-ray be replaced by NDT methods which improve radiation protection?
- Six possible substitutions:
 1. X-ray for gamma.
 2. Ultrasound for gamma/x-ray.
 3. Magnetic particle for gamma/x-ray.
 4. Dye penetrant for gamma/x-ray.
 5. Eddy current for gamma/x-ray.
 6. Leakage testing for gamma/x-ray.
- Long story short: Only options 1 & 2 were considered viable.



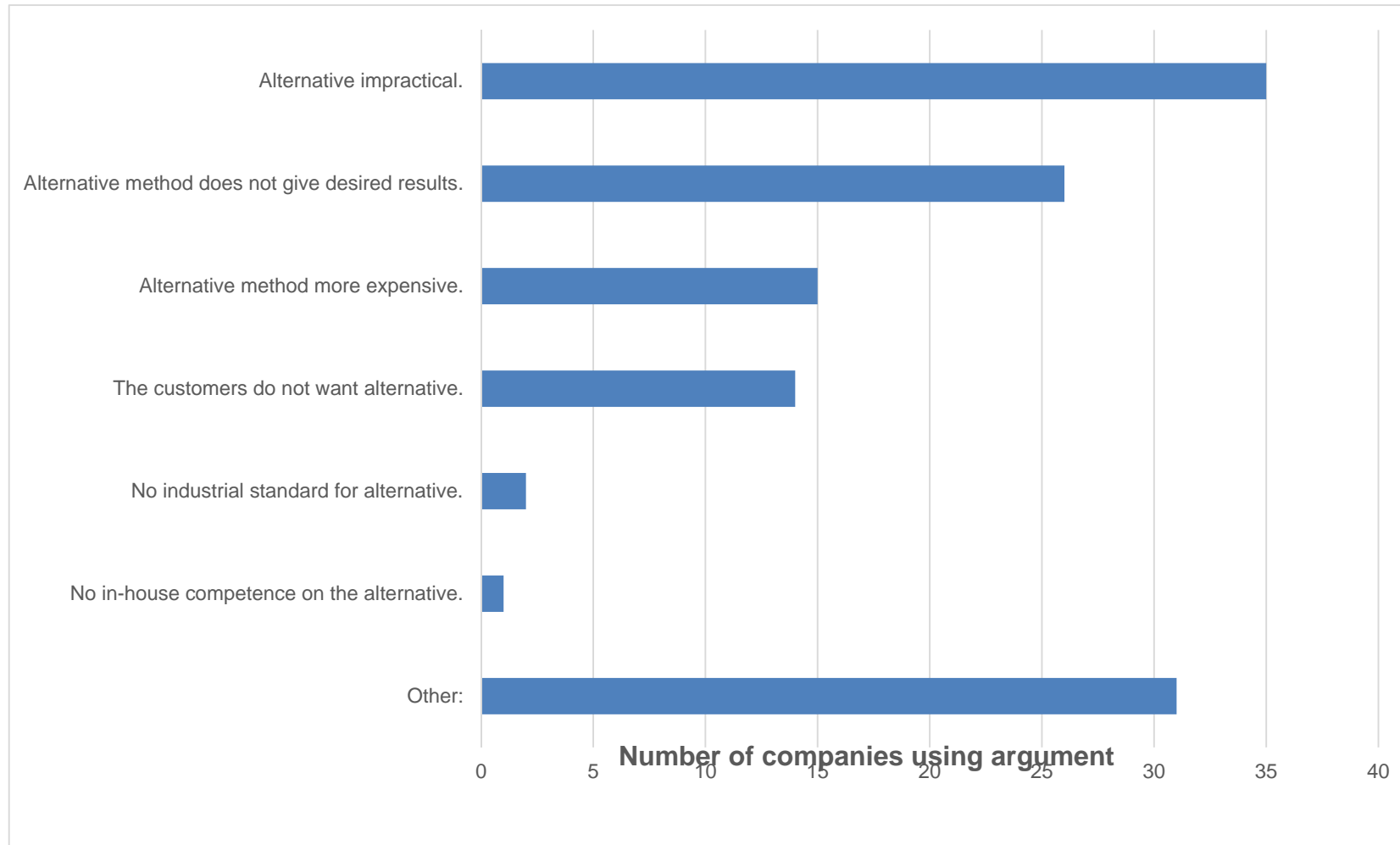
How many gamma examinations could be performed with x-ray?



About two thirds of the companies (64 %) believe that at least some gammaradiography can be replaced with x-ray radiography.



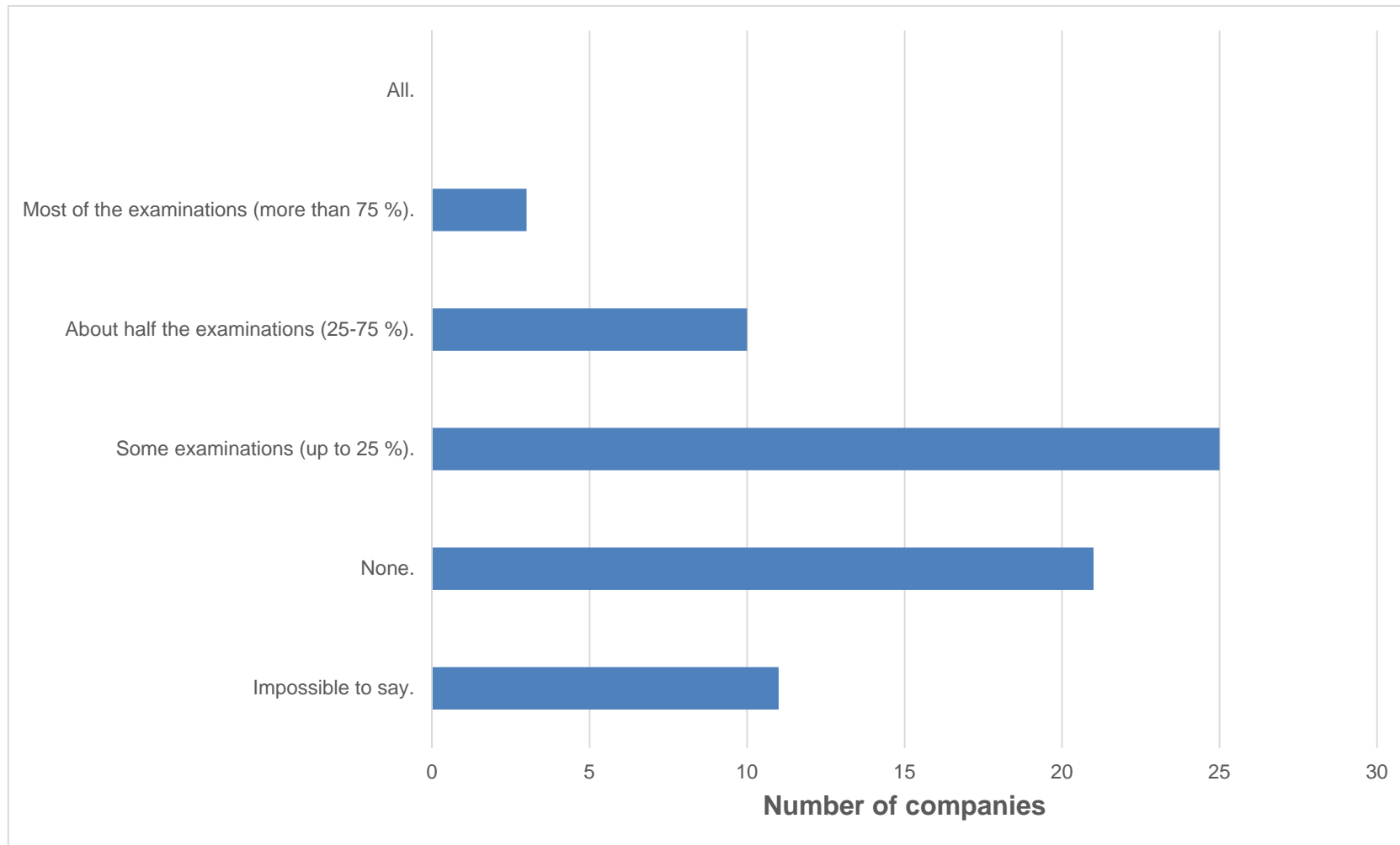
What prevents x-ray from replacing gamma radiography?



Main argument against x-ray radiography is accessibility for relatively large equipment, poorer image quality and expense for customer (x-ray taking longer).



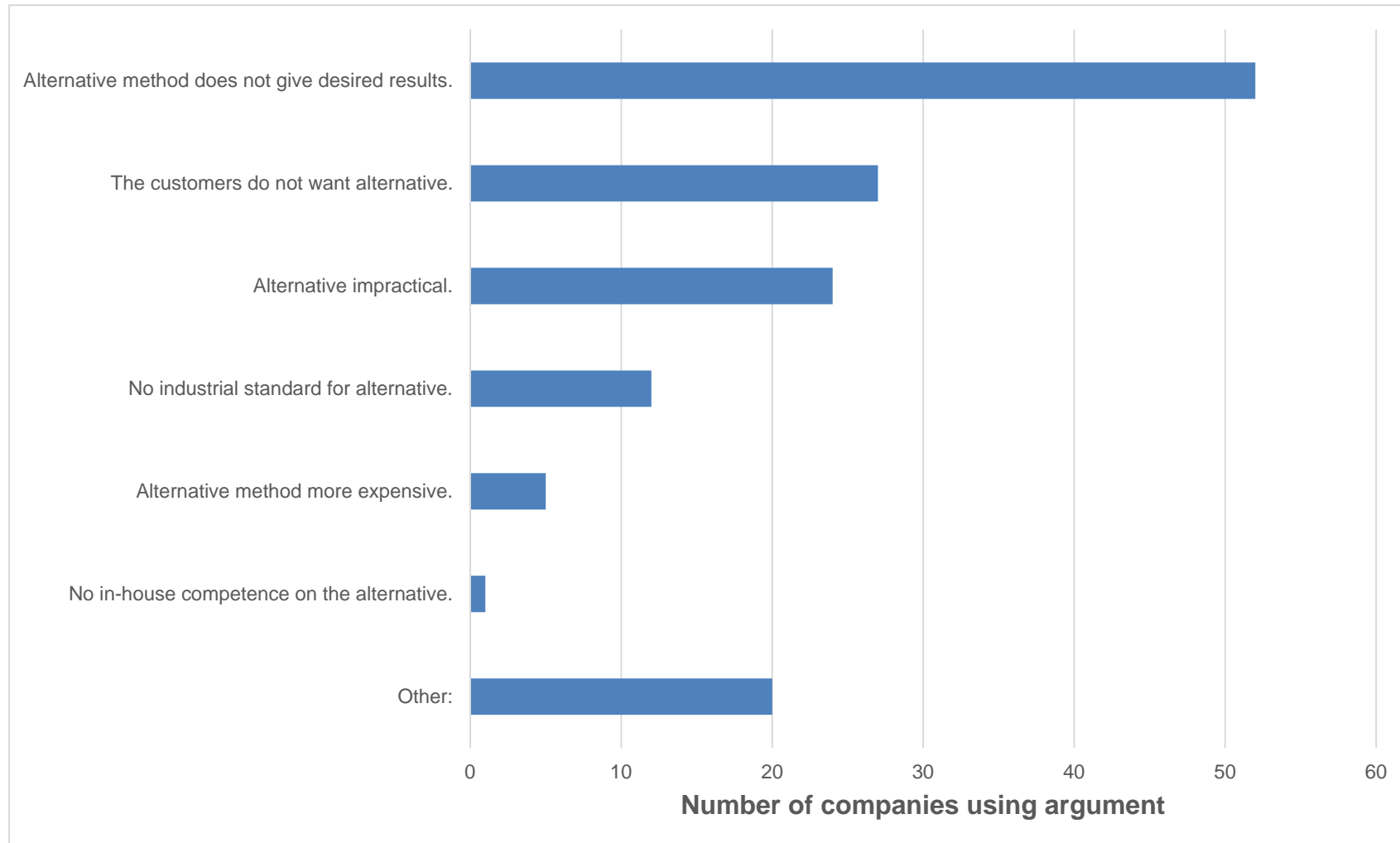
How many gamma/x-ray examinations could be performed with ultrasound?



About half the companies believe that at least some gamma/x-ray radiography can be replaced with ultrasound.



What prevents ultrasound from replacing gamma/x-ray radiography?



The main problem with ultrasound replacing ionising radiation is that it cannot be applied in all situations (thickness of objects).

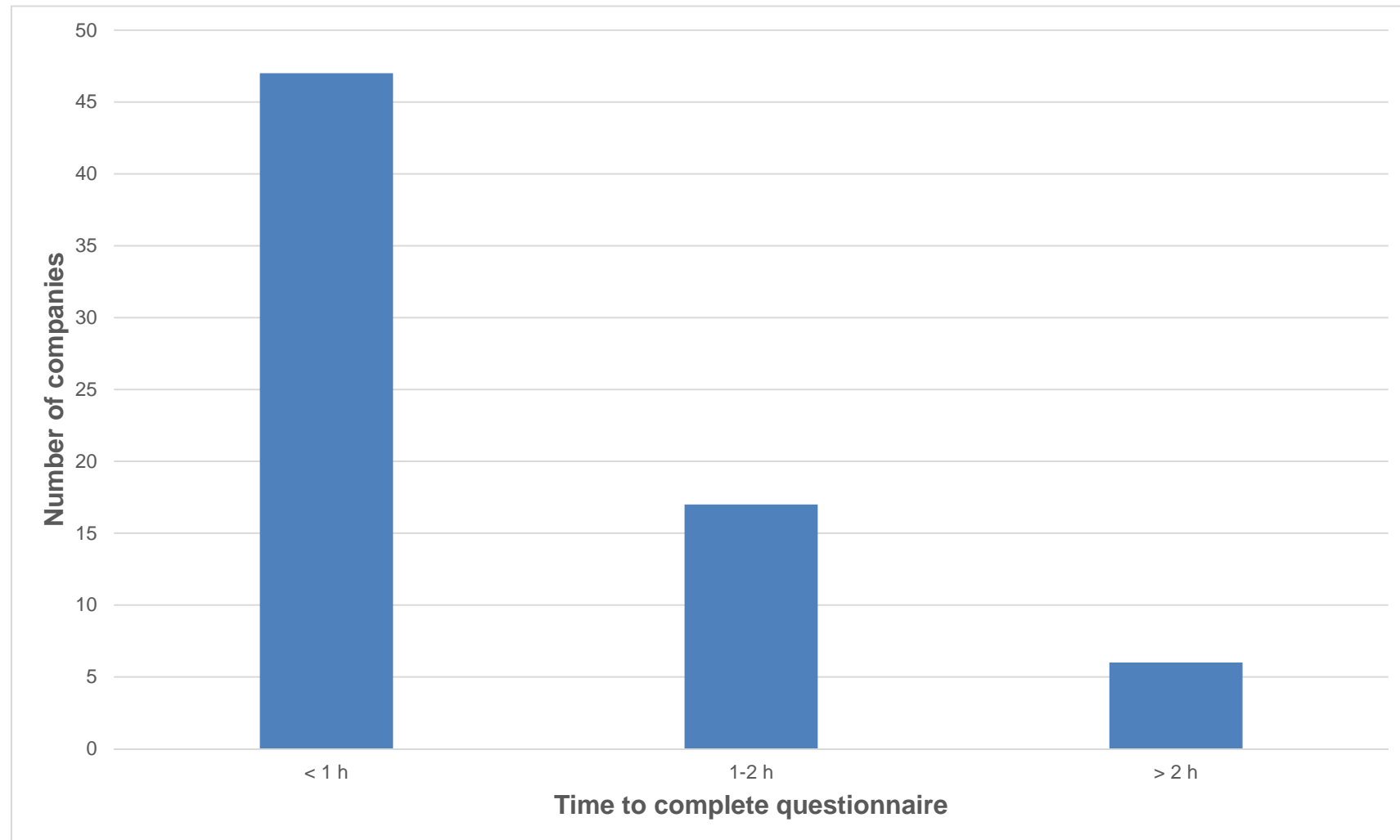


Substitution «conclusion»?

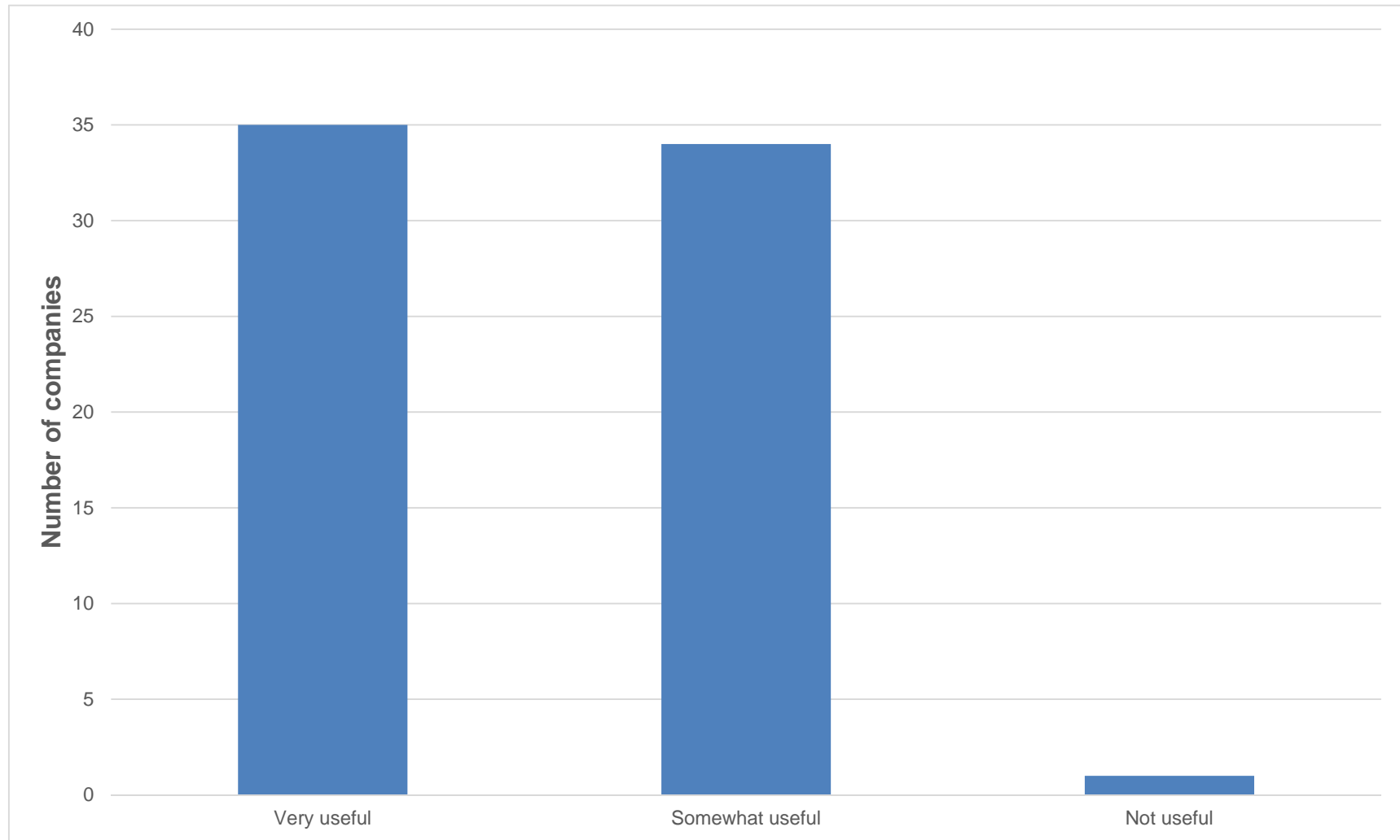
- There is potential for increasing use of x-ray to replace gamma and ultrasound to replace gamma/x-ray, and many companies phase out gamma for their own radiation protection purposes.
- Main obstacles for substitution are accessibility (size of x-ray) and applicability (object dimensions for ultrasound).
- Economical considerations may work against substitution, as x-ray takes longer, making it more expensive for customer.
- Technology developing rapidly, can authorities find incentives to speed substitution up?



Feedback – time spent



Feedback - usefulness



Conclusion

- Web-based inspections feasible – response rate 100 %.
- Much data gathered – quantity over quality.
- Future inspections may:
 - Utilise feature of «conditional questions».
 - Ask for attachment of documents (although currently not a feature in EasyResearch™).
- Method may also be applicable for inspections in other areas (veterinary, dentist, control sources, etc.)

