

Catching Contaminants: 5 Steps to Decide What Equipment Fits Your Needs and Budget

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Key Words

X-ray inspection, X-ray safety, physical contaminants, payback, total cost of ownership, TCO



Contaminants are a fact of life for food manufacturers, which makes contaminant detection a necessity.

Contaminants come in all shapes and forms, including microscopic elements such as bacteria and chemicals. Our focus is on choosing the right solution to detect physical contaminants or foreign objects, such as glass, metal, plastic, rocks or bones.

The following 5-step process is one way to calculate the payback of purchasing metal detectors or X-ray systems to detect these contaminants. We'll look at the initial and continuing costs as well as the savings to your operation.

But before we get to the numbers, let's put the issue in context.

Step 1: Look at your manufacturing facility. What types of contaminants are you facing? Why and how are they ending up in your process?

Physical contaminants can come from many sources, including:

- Raw materials – larger items such as bones, shells, seeds and rock
- Machinery – loose, worn or fragments of small broken parts that can end up in packaging
- People – improper or inadequate training or accidental or intentional actions can lead to contamination
- Processes – ingredients from other production sources, poor sanitation, etc., can be factors
- Environmental – building construction materials may find their way into products

While extremely small contaminants can end up in your products without causing any harm, the concern, of course, is when bigger and potentially dangerous items end up in your final packaged products.



Step 2: Look at where you're most likely to detect contaminants.

Review where in the process you're likely to detect physical contaminants. There are several possible spots in the typical food production process. The later in the game you find unwanted materials, the more it will cost your company:

- ▼ In an ingredient in-line
- ▼ In a packaged product in-line
- ▼ In a case before shipping
- ▼ At a warehouse before sale
- ▼ On a store shelf (*recall*)
- ▼ In a customer's home (*recall*)

Never (*the customer finds it for you*)

This step helps you think more about the real costs of contaminants, which as we shall see later can be huge.

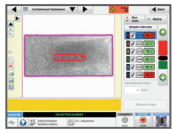
Step 3: Determine which type of detector you're most likely to need.

Both metal detectors and X-ray systems can find physical contaminants. Which technology is right for your application and process depends on many factors which are explored in greater detail in another white paper www.thermofisher.com/MDorXR, along with a look at the latest generations of the technologies.

In the meantime, consider the types of contaminants each technology can detect as summarized in this table:

Contaminant	Metal Detector	X-ray Machine	Comments
Ferrous, non-ferrous and stainless steel	1.5-3 mm	1-3 mm	Many application considerations.
Aluminum	Yes	Sometimes, depending on size.	X-ray see through thin aluminum foil.
Wires and needles	Yes (watch for orientation effect)	Sometimes, depending on size.	Depends on diameter, composition, orientation, hollow/solid.
Glass	No	≥ 2 mm soda lime composition	Depends on density, position, product type.
Stones/rocks	No	Most of the time ≥ 3 mm	Same comments as glass, with more possible variation.
Plastics	No	Sometimes if large/thick. Consider detectable plastics.	PVC easiest. Plastic gloves undetectable. Test samples to determine usage.
Bones	No	Sometimes, calcified.	
Pits/shells	No	Rarely	Depends on application, but difficult.
Insects	No	No	Due to density.
Wood	No	No	Due to density.

Cumulative Cash Flow									
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total	
Expenditures									
Equipment cost	\$ (20,000)							\$ (20,000)	Entry level
Installation/start-up	\$ (1,000)							\$ (1,000)	Customer
Training		\$ (500)	\$ (500)	\$ (500)	\$ (500)	\$ (500)		\$ (2,500)	Intermediate
Spare parts									
Engineering services	\$ (1,000)							\$ (1,000)	Electrical
Disposal of old equipment	\$ (500)							\$ (500)	Wear part
Operating cost		\$ (500)	\$ (500)	\$ (500)	\$ (500)	\$ (500)		\$ (2,500)	Customer
Maintenance cost		\$ (500)	\$ (500)	\$ (500)	\$ (500)	\$ (500)		\$ (2,500)	Two years
Unscheduled downtime		\$ (2,000)	\$ (2,000)	\$ (2,000)	\$ (2,000)	\$ (2,000)		\$ (10,000)	
Extended warranty/service contract		\$ (2,500)	\$ (2,500)	\$ (2,500)	\$ (2,500)	\$ (2,500)		\$ (12,500)	
Other									
Total	\$ (24,000)	\$ (3,000)	\$ (3,000)	\$ (3,000)	\$ (3,000)	\$ (3,000)		\$ (14,000)	
Savings									
Scrap reduction	\$ 15,000	\$ 15,000	\$ 15,000	\$ 15,000	\$ 15,000	\$ 15,000		\$ 75,000	Due to re-
Rework reduction	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000	\$ 2,000		\$ 10,000	Customer
Inspection charges avoided	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000	\$ 10,000		\$ 60,000	Thermal
Product returns eliminated									Assume
Total	\$ 27,000	\$ 27,000	\$ 27,000	\$ 27,000	\$ 27,000	\$ 27,000		\$ 163,000	



As you can see, there are cases for each.

If all you're worried about is finding aluminum, a metal detector may be adequate. But if you have concerns about glass or plastics ending up in your products, X-ray machines are the way to go. And if you have different contaminants to worry about in different parts of your plant, you may want to buy a metal detector for one phase and an X-ray machine for another.

So let's look at how you might calculate the finances of buying each of these machines.

Step 4: Do the math of acquiring and running the equipment.

Because equipment to detect contaminants does not earn revenue and is usually a capital expenditure, managers can be hesitant to recommend making such purchases. But adding detection equipment to your manufacturing facilities can pay off relatively quickly.

We've developed an easy-to-use **worksheet** www.thermofisher.com/InspectionPayback for calculating the costs and benefits associated with each equipment type. One big assumption here: These calculations assume that your operation isn't facing a lawsuit or unwanted publicity from contaminants reaching consumers (more about that in a second).

The Costs

Obviously, you're going to face an initial outlay for the equipment that likely will outweigh the financial benefits the first couple of years. The initial costs include:

- **The system purchase price** – Figure about \$20,000 to \$40,000 for metal detectors and \$35,000 to \$200,000 for X-ray equipment. (Leasing is an option.)
- **Installation, set-up and training** – These costs can run from \$1,000 to \$2,000 a day.
- **Spare parts** – Figure about 10% of the purchase price of the equipment itself.
- **Engineering/disposal of previous system (if applicable)** – These costs vary.

Once the system is up and running, you'll have ongoing expenditures:

- **Operating costs** – Electricity, air and floor space.
- **Maintenance costs** – Preventative and as-needed repair.
- **Unscheduled downtime** – If the equipment is down, you may face the costs of getting it repaired, discarding product as well as the lost profits of not being able to ship your product.

The Savings

On the other side of the equation are the costs you'll avoid by having this equipment part of your daily operations:

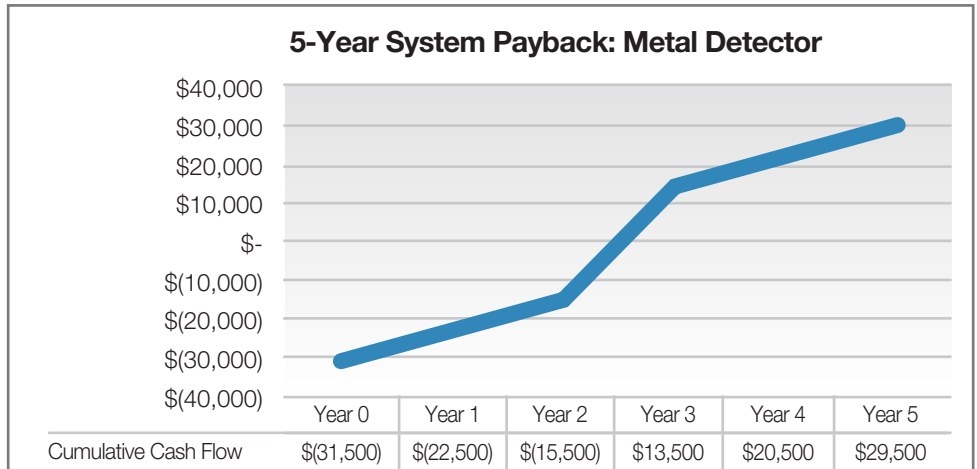
Scrap reduction – Without the detection equipment, you'd incur the costs of quarantining batches of your products, as well as the costs of shipping products that can't be used and have to be disposed.

Rework reduction – The equipment can help you avoid the costs of the labor and repackaging of products that can be saved. Of course, not all food products can be recovered – some must be scrapped.

Inspection charges avoided – Those products that are pulled from your production need to be re-inspected, of course. That typically will cost you about 10-15% of the retail price of the product, plus any rental equipment and contract labor.

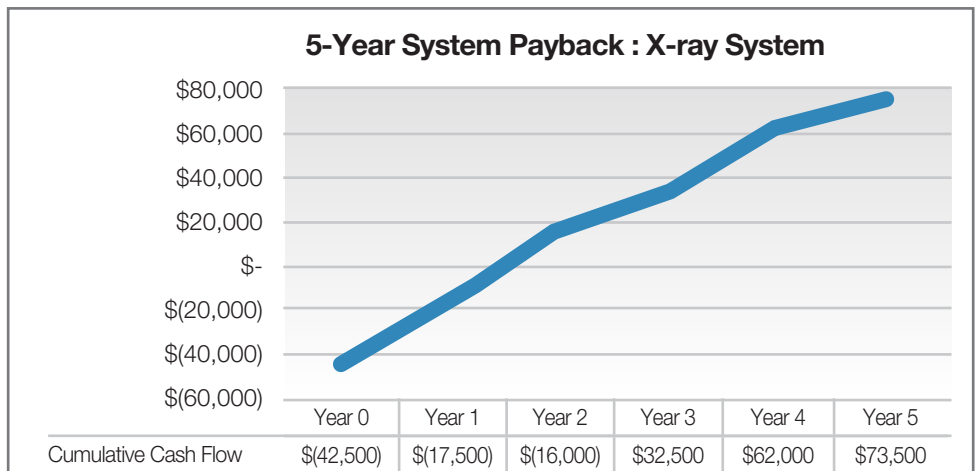
Elimination of product returns – By removing the contaminants before they reach the store shelves and consumers, you're avoiding the costs of getting the products returned.

We've plugged in some numbers here for typical scenarios in buying each of these types of equipment. Our [workbook](#) generates a payback curve for a metal detector that looks like the graphs below:



The X-ray equipment costs more initially, but typically pays for itself more quickly and produces a higher overall return over the five years considered.

Of course, these are only estimates – your equipment will have its own payback curve. But these numbers are a good benchmark based on realistic expectations, so they indicate what a typical manufacturer might expect in terms of Total Cost of Ownership (TCO) over that period.



Your finance department probably has its own methods for determining TCO for equipment purchases and other capital expenditures. But to give you a starting point, you may want to try our [workbook](#) to get a rough idea of what to expect.

Step 5: Imagine A Worst-Case Scenario.

The calculations we've gone through assume we're only looking at costs associated at worst with a neat, clean recall. Of course, in the real world, a stray contaminant could mean lawsuits, damage to your company's reputation, and the like.

Consider the case of metal that went undetected from a Kraft plant making a microwavable Velveeta® cheese and shells product. The company discovered that wire bristles found their way into the product and voluntarily recalled 137,000 cases of the packaged food. The day before, a man who had eaten the food was undergoing surgery for a perforated bowel he blamed on the stray metal. Suddenly, Kraft Heinz found itself facing a \$6.5 million lawsuit – as well as the bad publicity reaching consumers from press attention to the case.

As you can readily see, the calculations we went through before become meaningless. The investment in detection equipment in this case would be a fraction of the money saved by keeping the bristles out of their food – and avoiding a lawsuit.

The Kraft Heinz case is not an isolated example. You'll find websites looking for food companies to sue who invite people to share information that could make a case. The trade publications are full of companies around the world issuing recalls.

Summing Up

Only you and the people in your operation, working closely with product inspection applications experts, can determine what equipment you'll need to reduce the risks of physical contamination. Calculating and comparing the payback potential among the options can help you secure buy-in for a solution that's tailored to your needs – one that will protect your brand and keep your consumers safe.

Ready to crunch the numbers?

[Download the workbook calculator](#)

www.thermofisher.com/InspectionPayback

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