

X-ray Vision – The New Look in Quality and Process Control



For: INFOFISH 2012

Bangkok, Thailand

Presented By: Allan Anderson

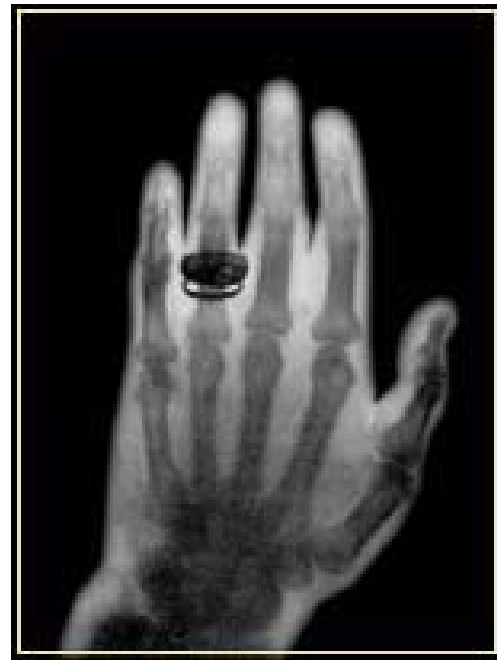
InspX LLC

Our Agenda

- What do you know about x-ray?
- What do you know about x-ray and food packaging and processing?
- What would you like to know?

What do you know about X-ray?

- “X-rays” were discovered over a century ago by Wilhelm Roentgen in 1895



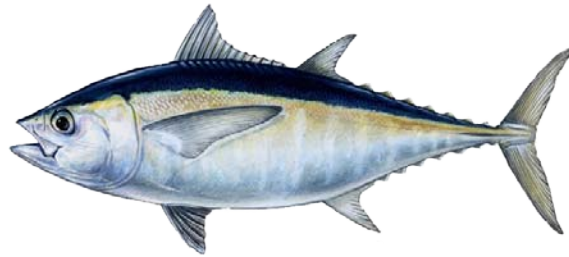
What do you know about X-ray?

- Your familiarity with x-rays is probably most influenced by medicine and security.



What do you know about X-ray and its potential for use in food processing and packaging?

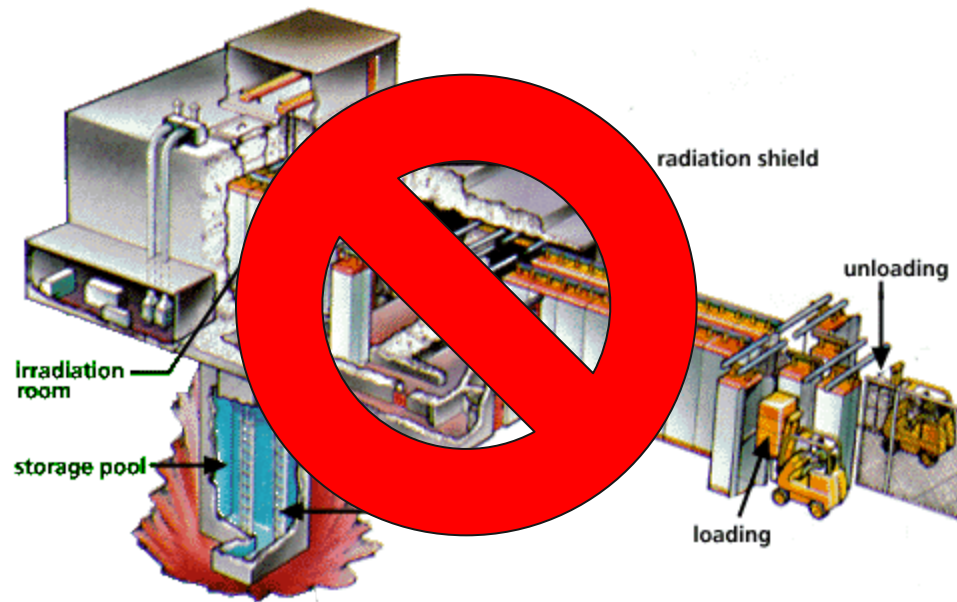
- Some things that x-ray in this context is not.



X-ray inspection does not include the x-ray inspection of live tuna.

What do you know about X-ray and its potential for use in food processing and packaging?

- Some things that x-ray in this context is not.



X-ray inspection does not include the x-ray irradiation of tuna and tuna products.

What do you know about X-ray and its potential for use in food processing and packaging?

- Some things that x-ray in this context is not.



X-ray inspection does not include the x-ray imaging of packages and tuna so that an operator looking at the image can make a judgment about what they see.

What do you know about X-ray and its potential for use in food processing and packaging?

- Some things that x-ray in this context is not.



X-ray inspection does not mean making a metal detector with different technology.

What do you know about X-ray and its potential for use in food processing and packaging?

X-Ray Detection vs. Metal Detection An Extension of Contaminant Detection

	Packaging Materials	Foreign Materials			
		Metal	Glass	Stone	Bone
X-Ray	Plastic				
	Composites				
	Glass				
	Metal Cans				
Metal Detection	Plastic				
	Composites				
	Glass				
	Metal Cans				



What do you know about X-ray and its potential for use in food processing and packaging?

X-ray Addresses Many Frequent Issues of Contaminant Complaint

- Bone in Meat and Poultry
- Glass in Glass Bottles and Jars
- Rocks in Beans (and similar)
- Metal in Metal Cans

What you would like to know.

Frequently Asked Questions from INFOFISH 2012

- What can x-ray inspect in my packaging and processing? (That is, What can x-ray inspect well?)
- What can I expect X-ray to detect in my tuna packaging and processing?
- What speed limitations are there?
- What worker safety issues will I have to deal with?
- What effect will the x-ray have on my product?

What you would like to know.

Frequently Asked Questions from INFOFISH 2012

- Where should I be considering locating an x-ray inspection system in my operations?
- What are some basic principles of x-ray inspection that would assist me in locating such a system?
- What does an x-ray system cost?
- What factors are influencing the adoption of x-ray inspection?

What can x-ray inspect in my packaging and process?

X-ray systems can inspect every package in the tuna mix as well as tuna loins.

This includes cans, pouches, and glass jars.



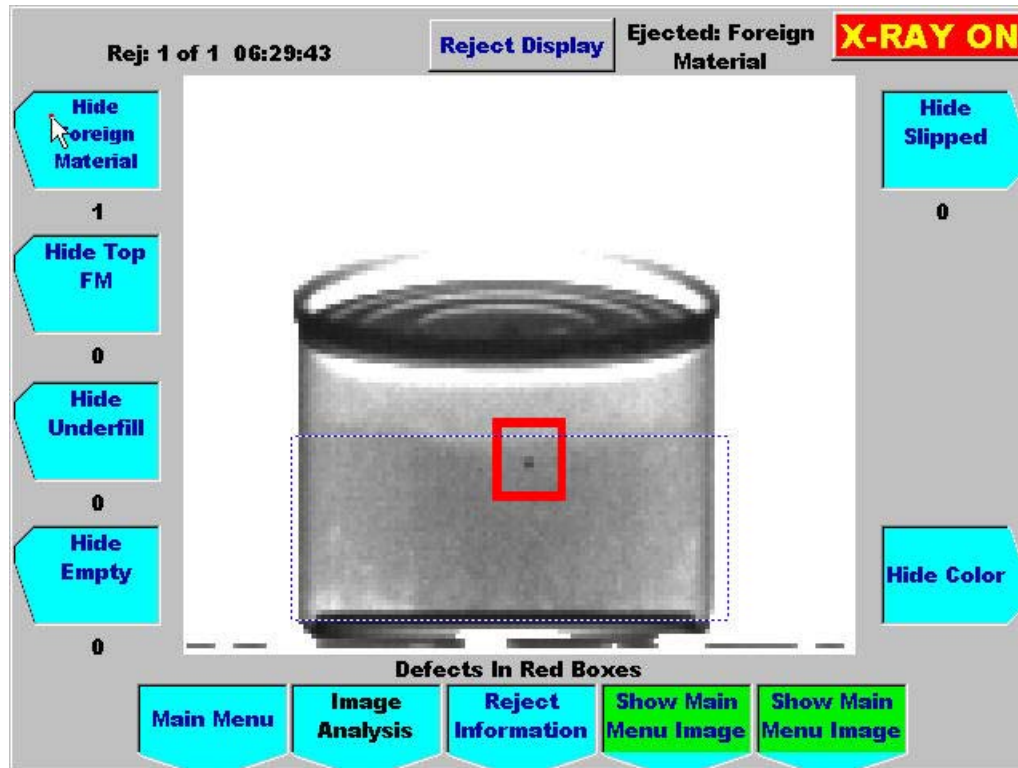
What can I expect X-ray to detect in my tuna packaging and processing?

The most important foreign material to be detected is bone, but x-ray serves also as a metal detector at points in any point in the process, in glass jars the x-ray will detect glass contaminants.



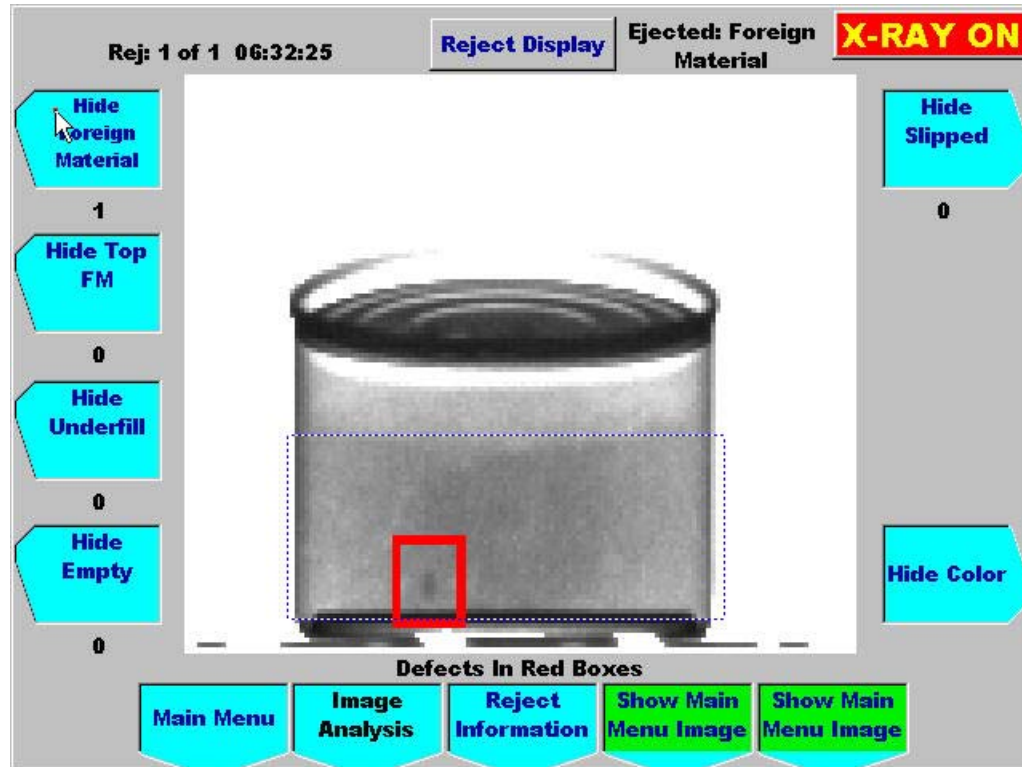


What can I expect X-ray to detect in my tuna packaging and processing?



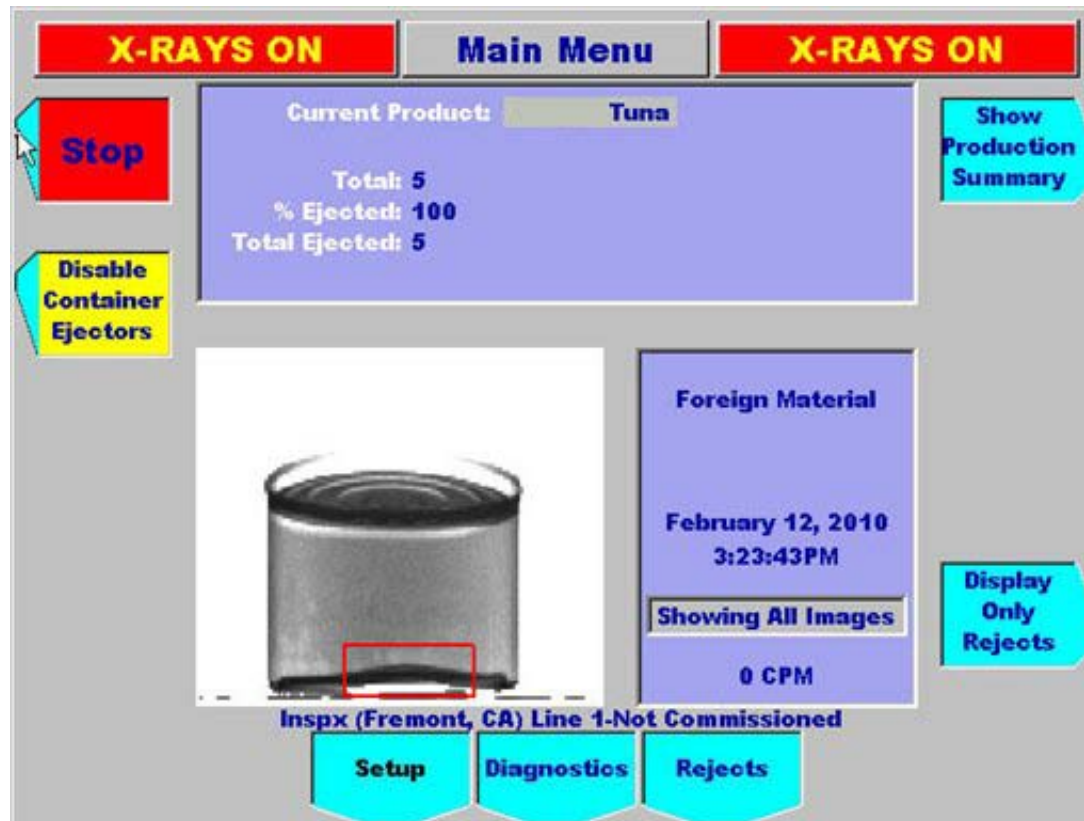
In cans, detection of a 1.5 mm stainless steel sphere should be expected. Best performance is on Aluminum cans (versus steel) and on two piece cans (when inspected seamed end up) versus three piece cans,

What can I expect X-ray to detect in my tuna packaging and processing?



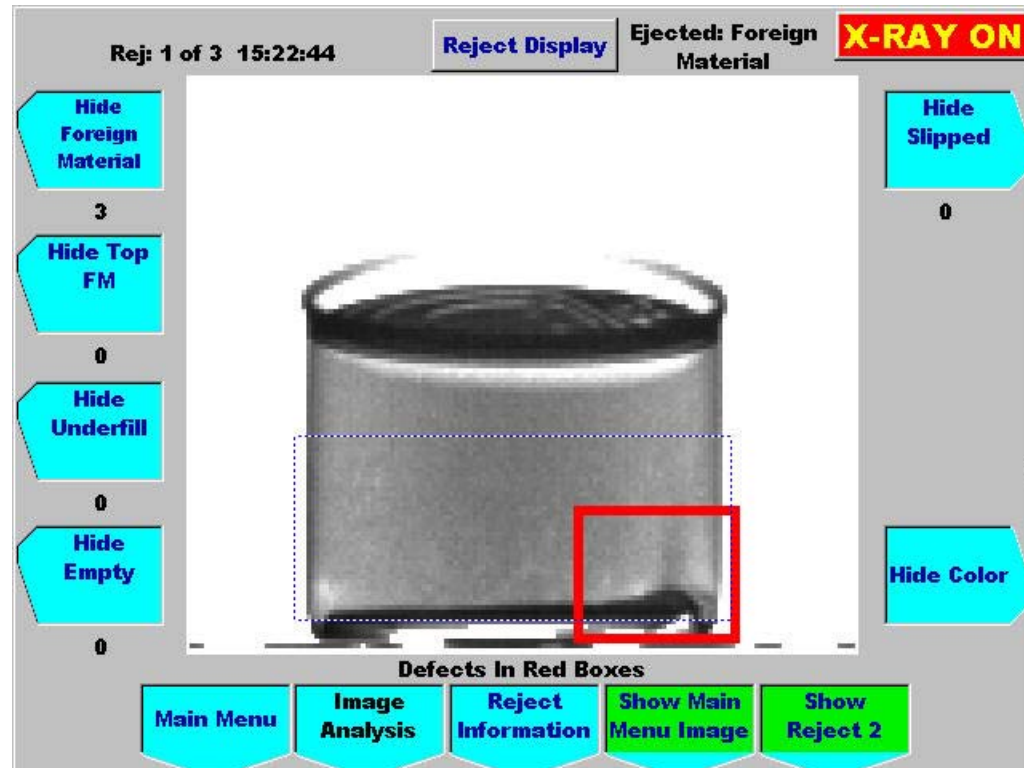
Detection of a 3.0 mm glass sphere can be expected in the middle of the can as shown here. For high probability of detection coupled with low false reject rate and detection throughout the can, use 4.0 mm as benchmark.

What can I expect X-ray to detect in my tuna packaging and processing?



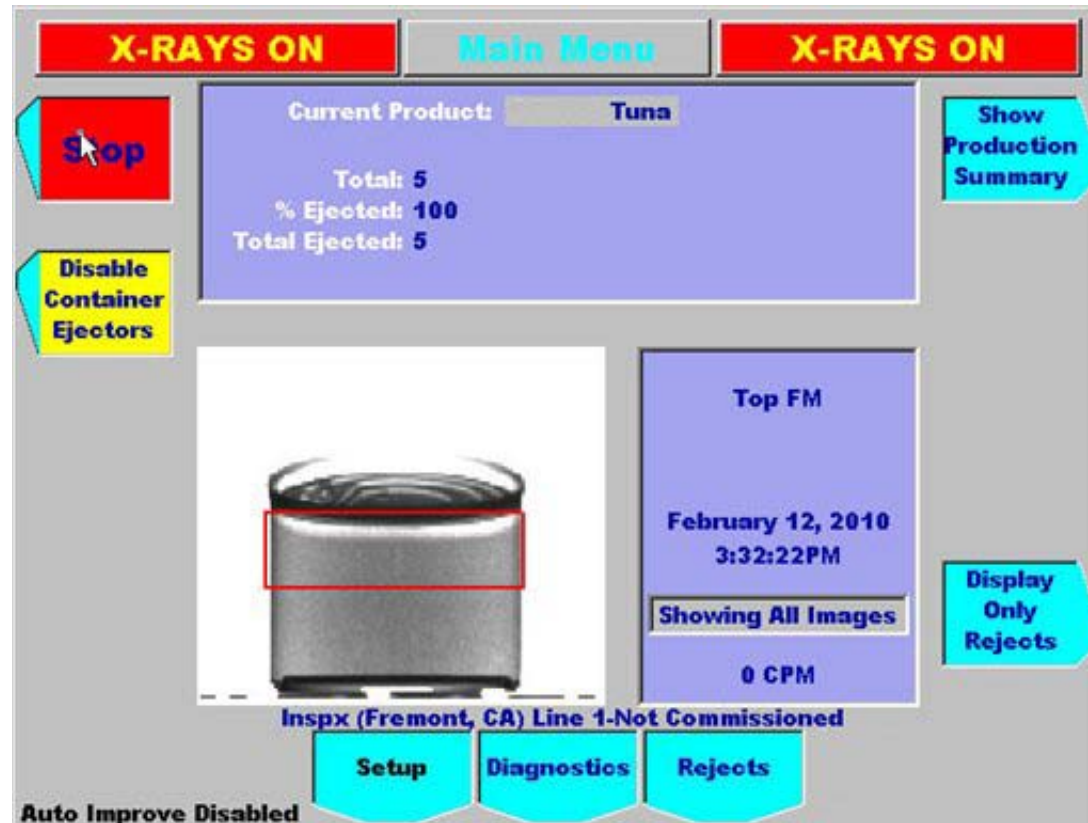
Can dents or irregular deflection as shown above will be detected.

What can I expect X-ray to detect in my tuna packaging and processing?



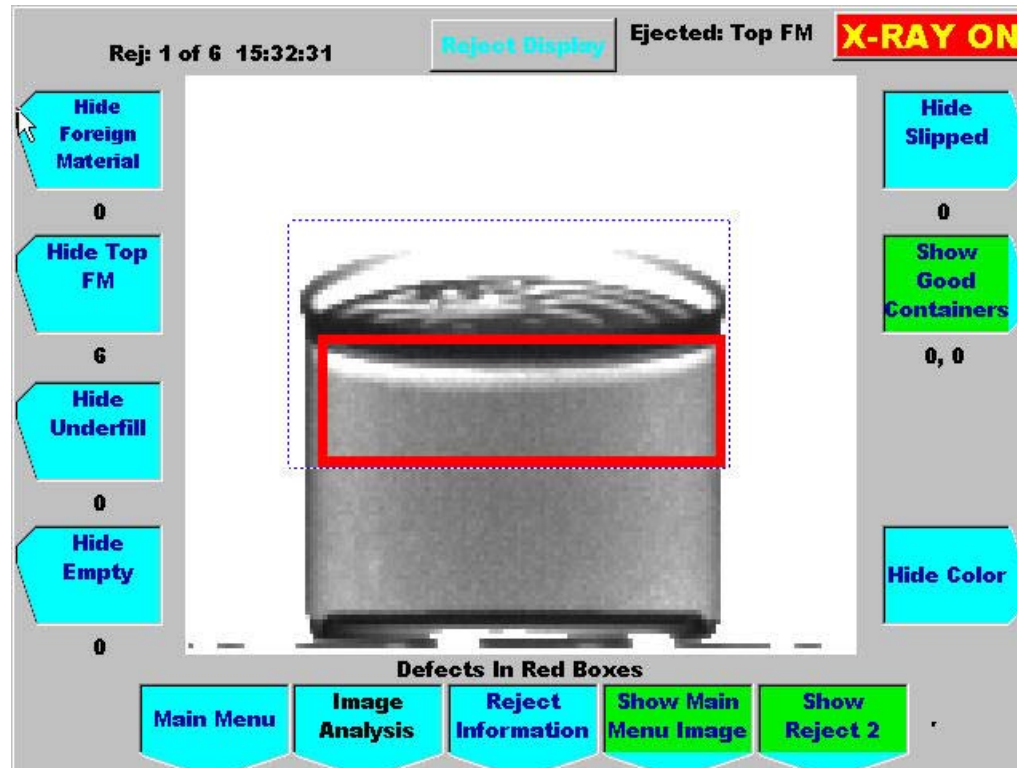
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What can I expect X-ray to detect in my tuna packaging and processing?



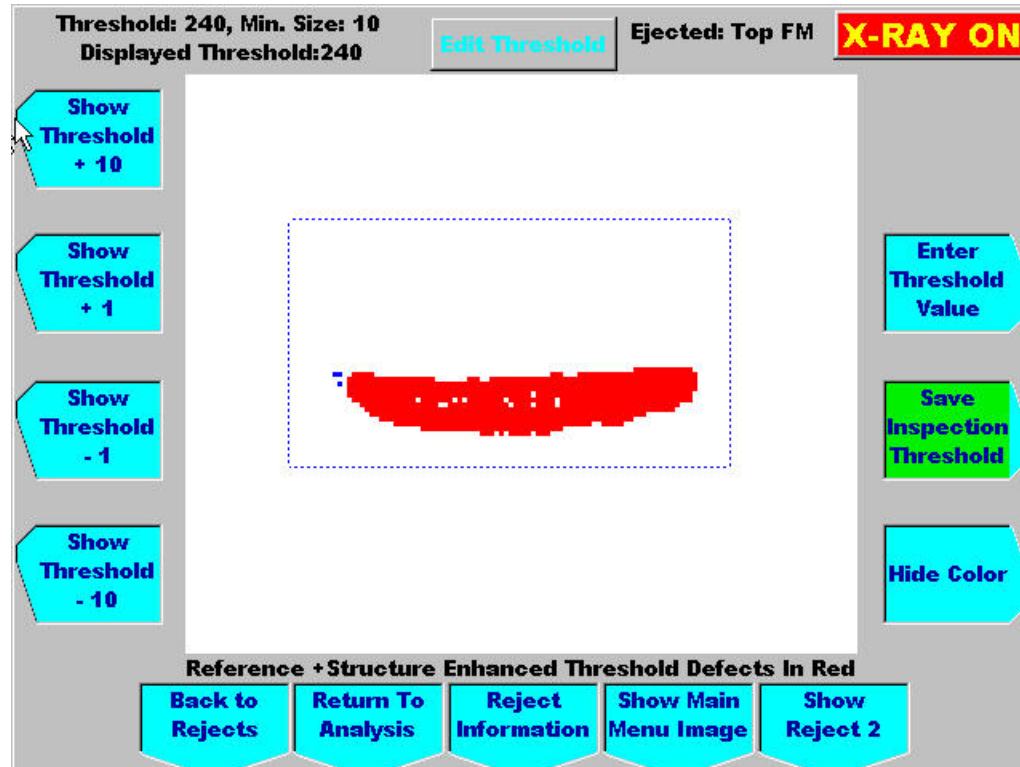
The algorithms used to detect differences can show up some interesting changes such as shown above where the entire top of the tuna can is highlighted.

What can I expect X-ray to detect in my tuna packaging and processing?



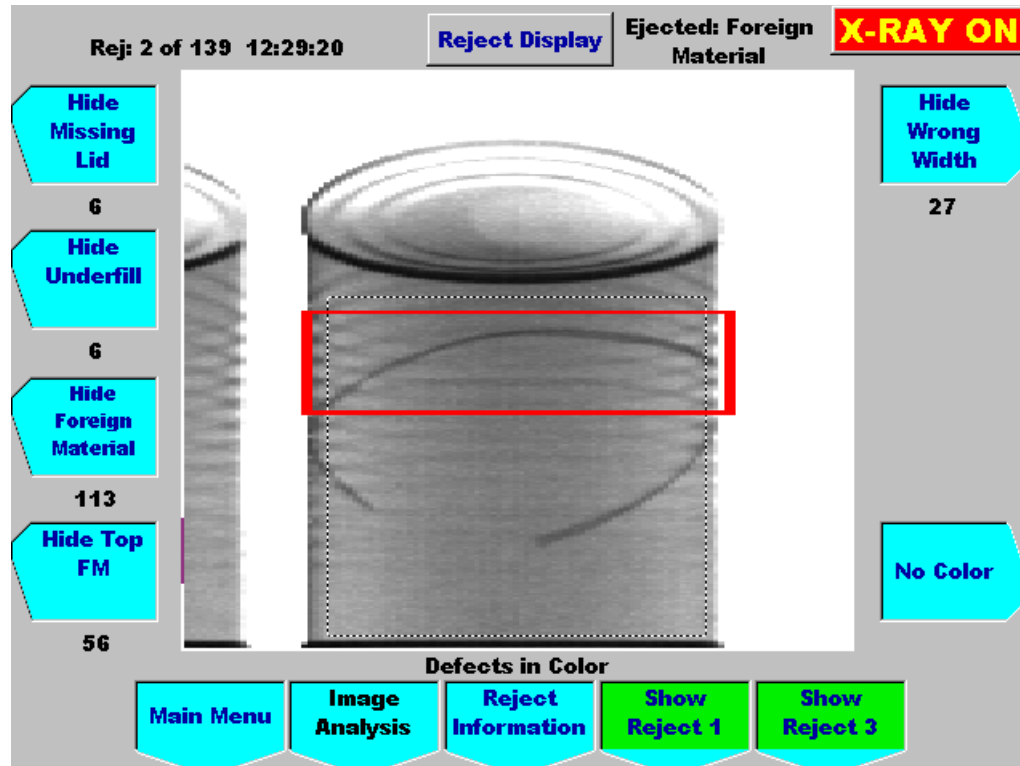
In an x-ray set-up to detect foreign material in tuna cans in oil, this fault is signaled.

What can I expect X-ray to detect in my tuna packaging and processing?



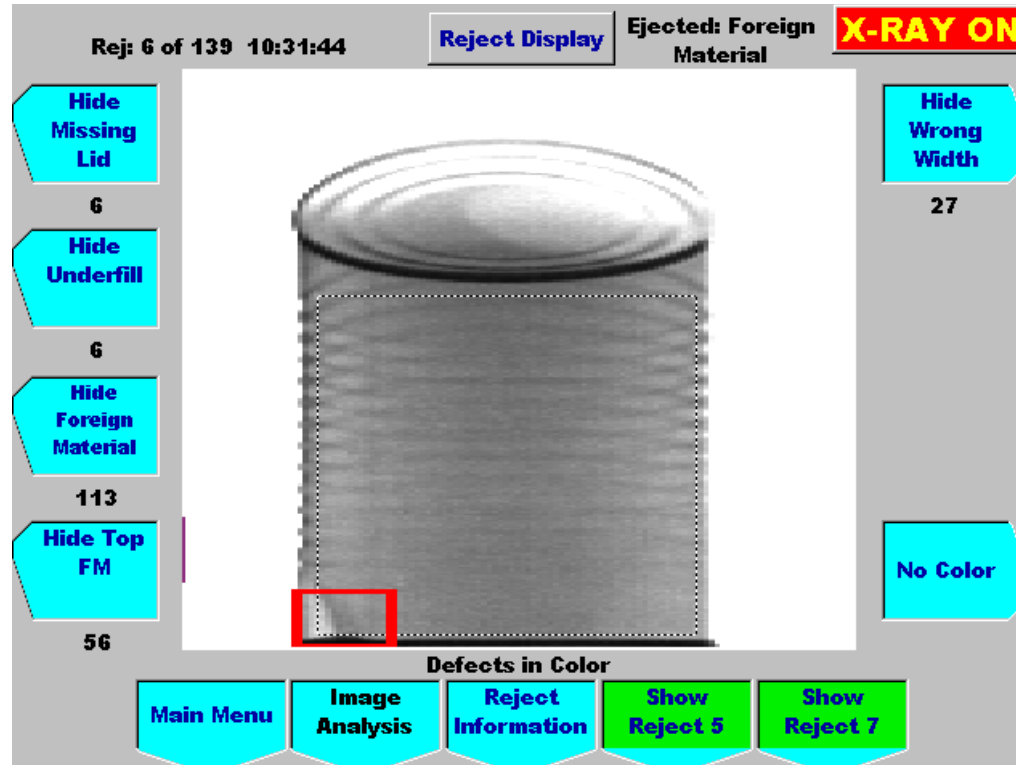
Through analysis of the defect the presence of brine in place of oil clearly presents the difference in density (the presence of salt) in this type of pack.

What can I expect X-ray to detect in my tuna packaging and processing?



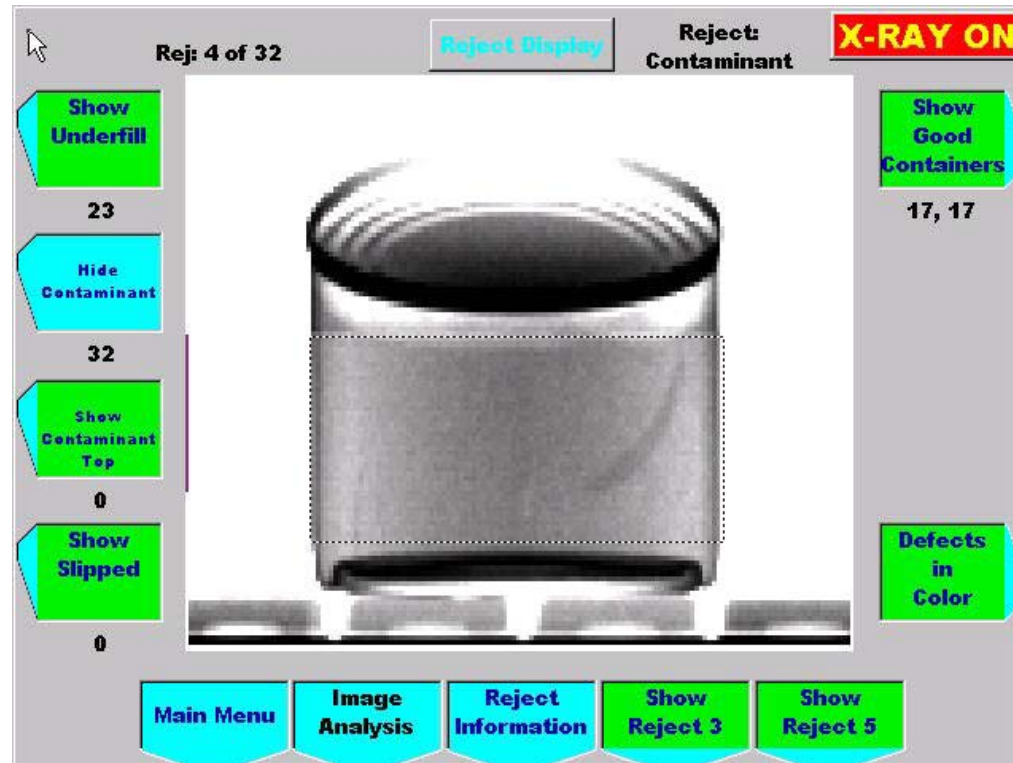
Problems in the manufacture of your cans will show up as shown in this trim ring lacquered in to the can.

What can I expect X-ray to detect in my tuna packaging and processing?



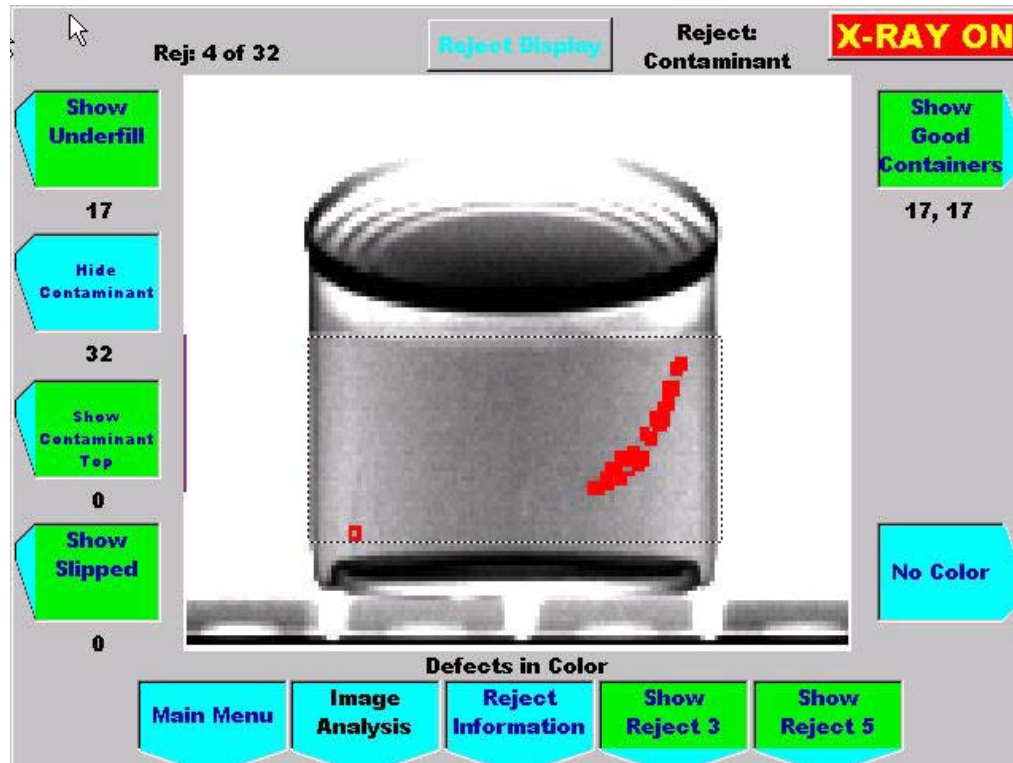
Seam defects such as this knocked down flange will be detected since these put material in a part of the image where it is not expected.

What can I expect X-ray to detect in my tuna packaging and processing?



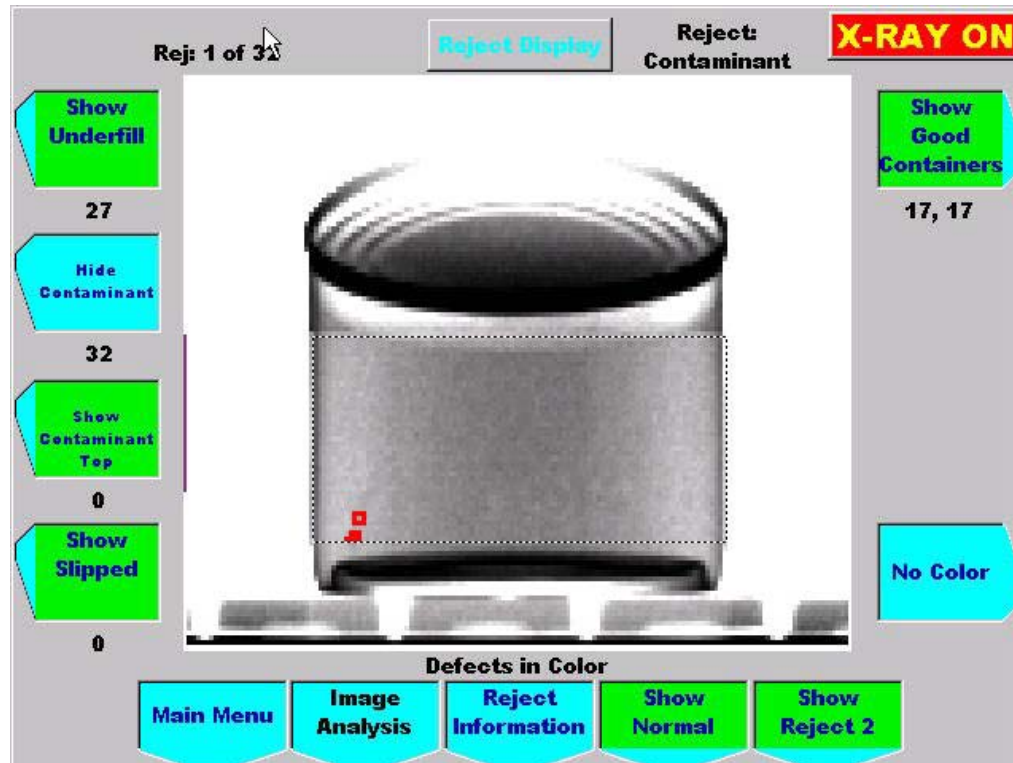
Bones will be detected as shown here (a rib bone).

What can I expect X-ray to detect in my tuna packaging and processing?



Upon analysis of the prior image another foreign material element was detected in the lower left.

What can I expect X-ray to detect in my tuna packaging and processing?



Removal of the rib bone still showed a foreign material presence. Upon analysis a very soft small bone (approximately 1.5 mm x 5 mm) was located..

What can I expect X-ray to detect in my tuna packaging and processing?



Rej: 13 of 214 21:47:36 Reject Display Ejected: Small Bones **X-RAY ON**

Hide Under Weight	0	Hide Contaminant R	49
Hide Small Bones	1,488	Hide Contaminant T	15
Hide Contaminant P	78	Hide Color	
Hide Contaminant Q	128		

Defects In Red Boxes

Main Menu Image Analysis Reject Information Show Reject 12 Show Reject 14

In the absence of dense packaging material such as glass and metal, the pouch, even metalized pouches as shown, will yield clear images of bone when they are present as above.

What can I expect X-ray to detect in my tuna packaging and processing?



Rej: 10 of 214 21:47:48 Reject Display Ejected: Small Bones **X-RAY ON**

Hide Under Weight	0	Hide Contaminant R	49
Hide Small Bones	1,488	Hide Contaminant T	15
Hide Contaminant P	78	Hide Color	
Hide Contaminant Q	128		

Defects In Red Boxes

Main Menu Image Analysis Reject Information Show Reject 9 Show Reject 11

In the absence of dense packaging material such as glass and metal, the pouch, even metalized pouches as shown, will yield clear images of bone when they are present as above.

What can I expect X-ray to detect in my tuna packaging and processing?



Rej: 15 of 214 21:47:28 Reject Display Ejected: Small Bones **X-RAY ON**

Hide Under Weight 0		Hide Contaminant R 49
Hide Small Bones 1,488		Hide Contaminant T 15
Hide Contaminant P 78		Hide Color
Hide Contaminant Q 128		

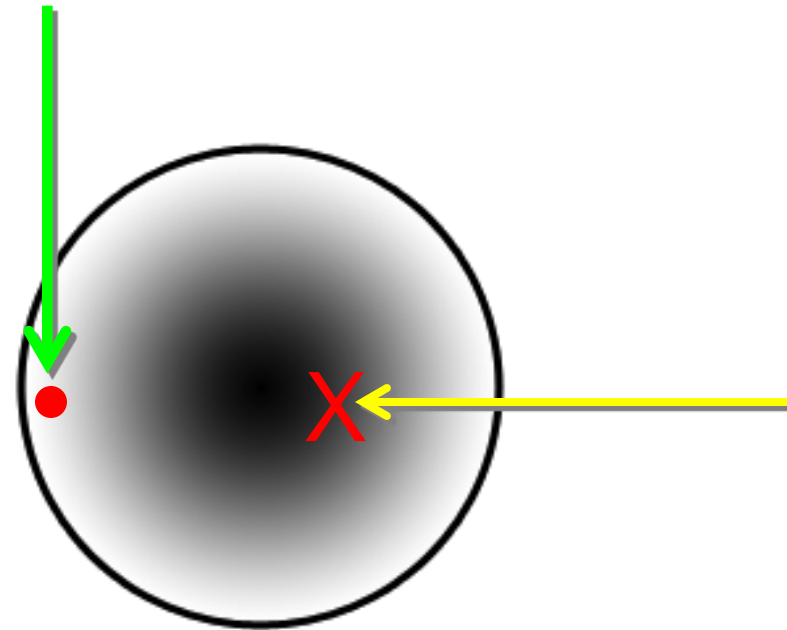
Defects In Red Boxes

Main Menu Image Analysis Reject Information Show Reject 14 Show Reject 16

In the absence of dense packaging material such as glass and metal, the pouch, even metalized pouches as shown, will yield clear images of bone when they are present as above.

What can I expect X-ray to detect in my tuna packaging and processing?

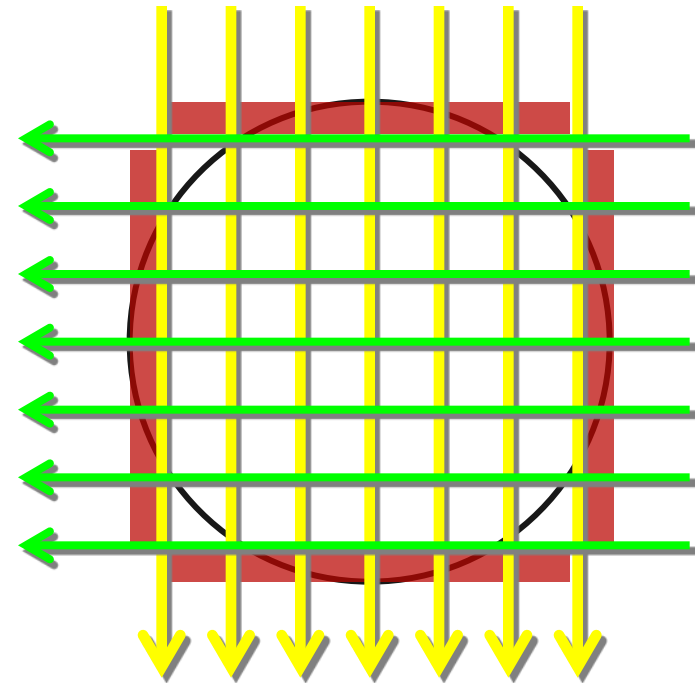
Seeing around the push-up (dome) on bottom of glass containers.



Single beam systems can't see around the push-up.

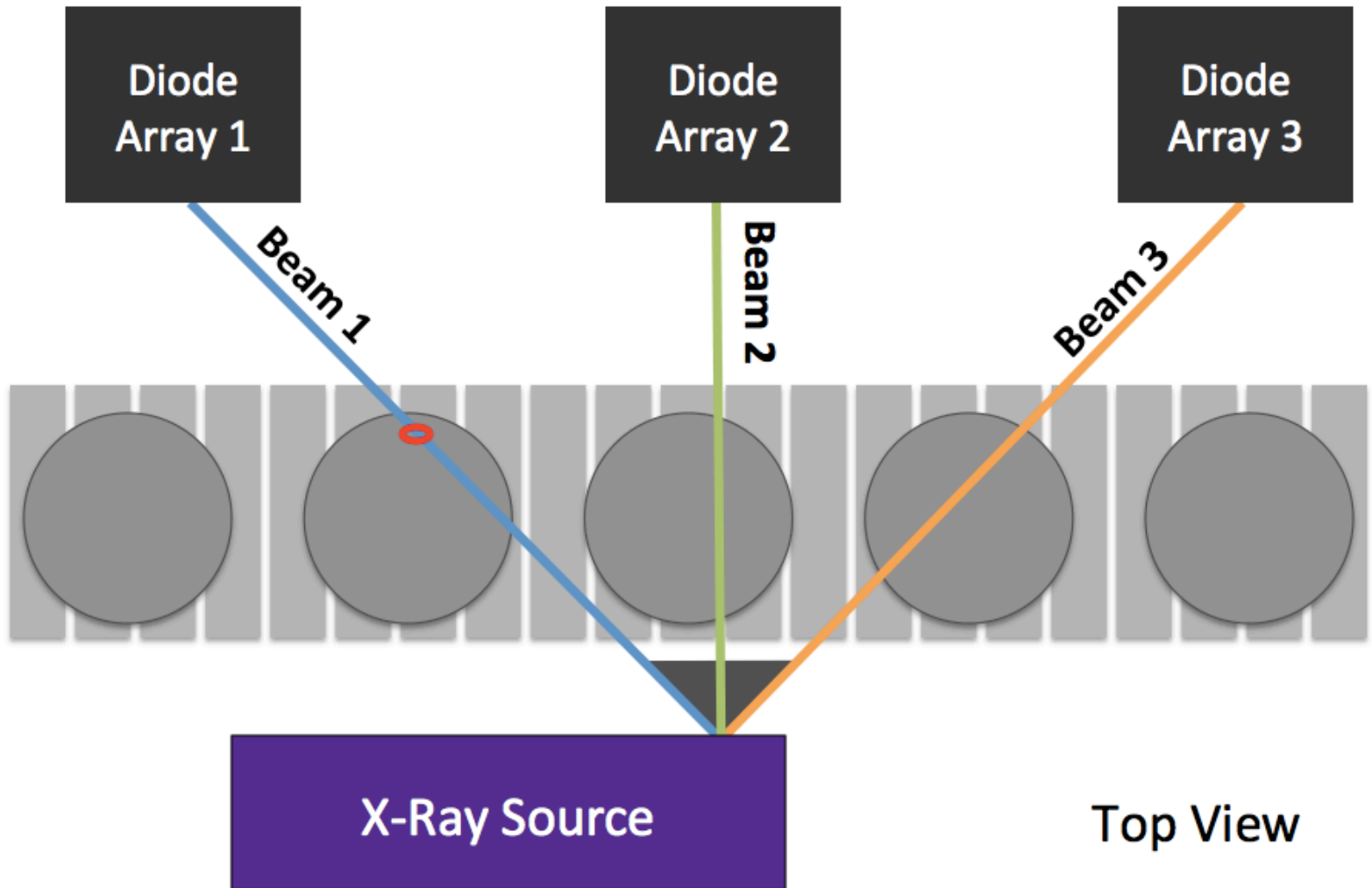
What can I expect X-ray to detect in my tuna packaging and processing?

Seeing along the walls



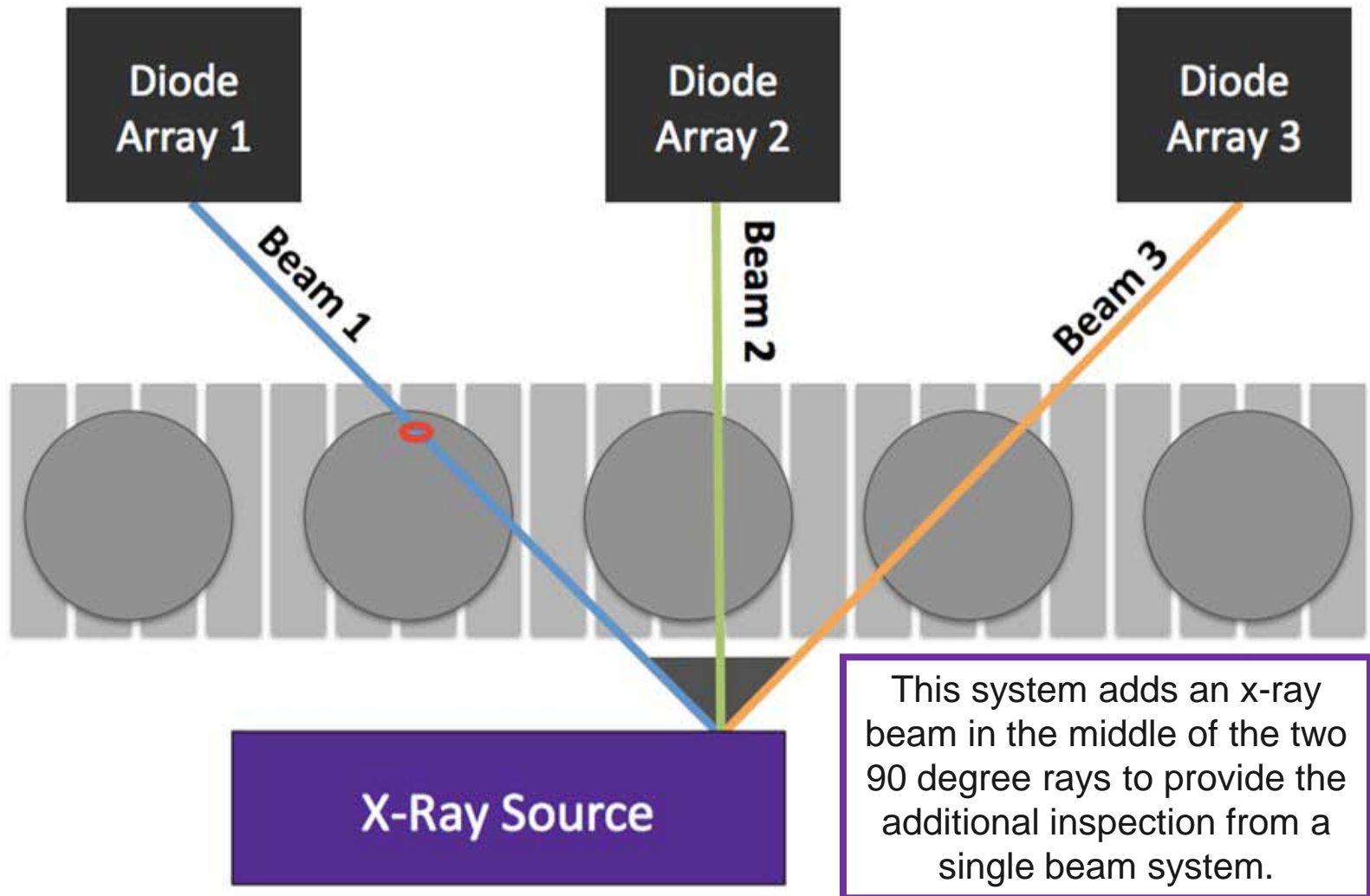
Glass container wall thickness varies a great deal. The difference between the thinnest and thickest wall can exceed 1 mm. This makes inspection close to the wall difficult. With two looks from a Duo, contaminants close to the wall or inclusions in the wall itself are easily detected..

What can I expect X-ray to detect in my tuna packaging and processing?



ScanTrac Trio

Triple Beam Inspection



What can I expect X-ray to detect in my tuna packaging and processing?

Statistically, the addition of a second inspection, adds approximately 40 percent to the probability of detection. The addition of a third inspection adds another 30 percent.



Supplementing the additional number of inspections, the change in angles of inspection from two and three beam systems further increase the probability of detection.

What can I expect X-ray to detect in my tuna packaging and processing?



The 4 mm glass sphere was inserted in the bottle and detected each of 25 consecutive times.

What can I expect X-ray to detect in my tuna packaging and processing?



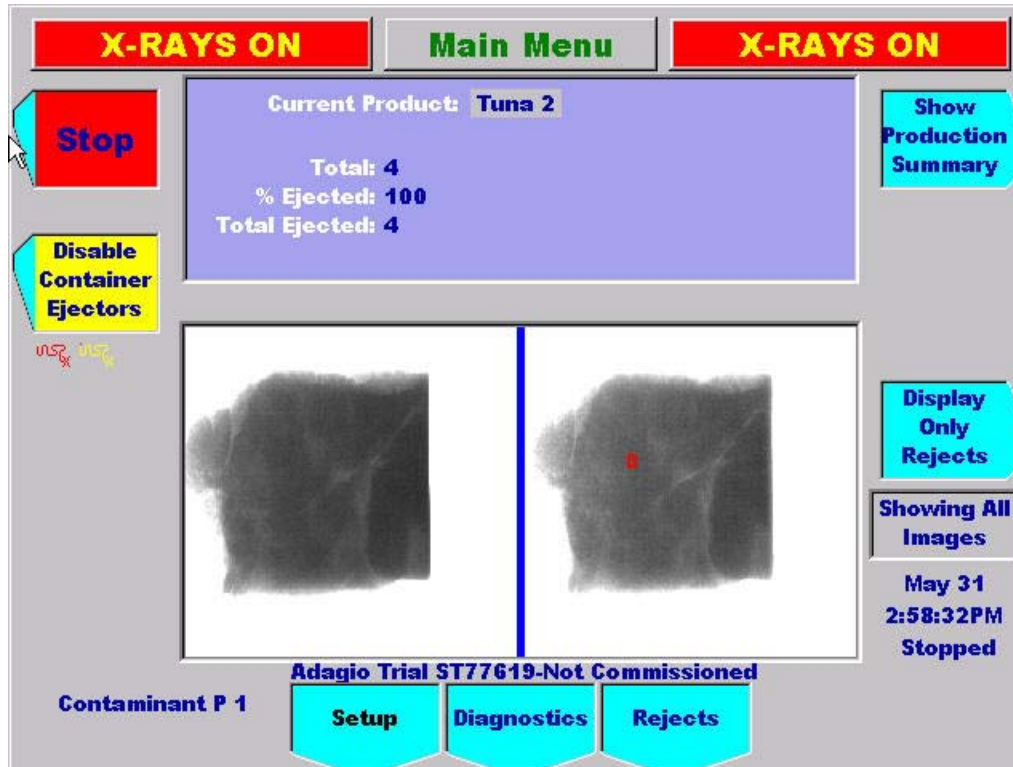
Loins packed as above or similar can be inspected on the x-ray belt systems. Inspection will be enhanced by close packing similar to that shown.

What can I expect X-ray to detect in my tuna packaging and processing?



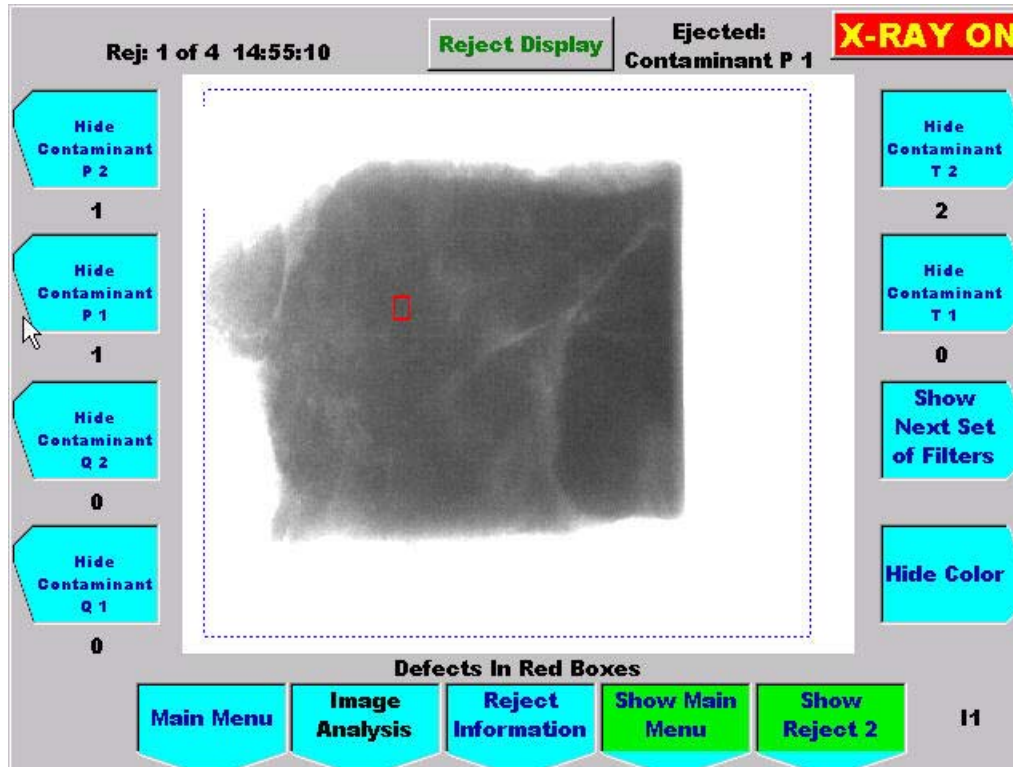
The loins are fed onto the x-ray inspection conveyor as shown above and moved through the uniquely configured x-ray inspection arrays that facilitate inspection over a broad range of loin sizes and dimensions.

What can I expect X-ray to detect in my tuna packaging and processing?



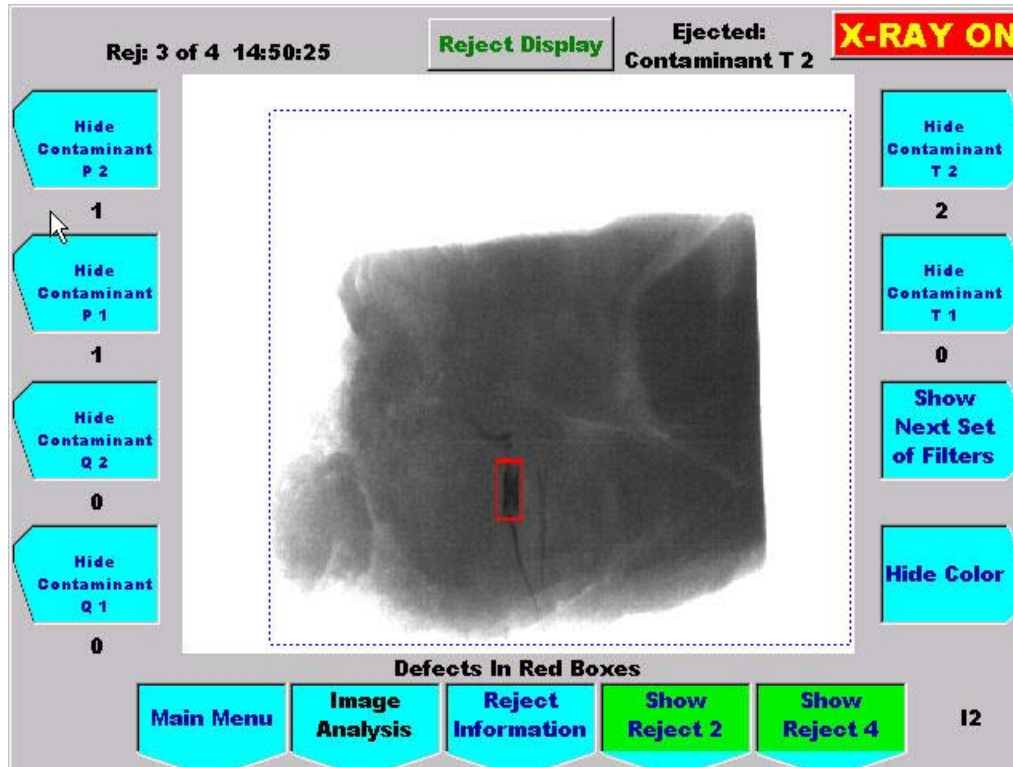
In this test using a two beam belt system, a 1 mm stainless steel sphere was moved around on the loin (see, previous pictures) and detected each time.

What can I expect X-ray to detect in my tuna packaging and processing?



This detail image of the 1 mm stainless steel sphere shows how little the contrast is in the image to the eye.

ScanTrac Adagio Tuna Loin Inspection



This bone sample from the vertebrae is detected by the two beam system in all presentations.

What speed limitations are there?

Systems are available to match the highest production and packaging speeds in the industry.



Conveyor speeds in excess of 200 meters per minute.



Conveyor speeds in excess of 100 meters per minute.



Conveyor speeds in excess of 200 meters per minute.

What speed limitations are there?



Cans are inspected at 20 per second for bones and other Foreign Material.

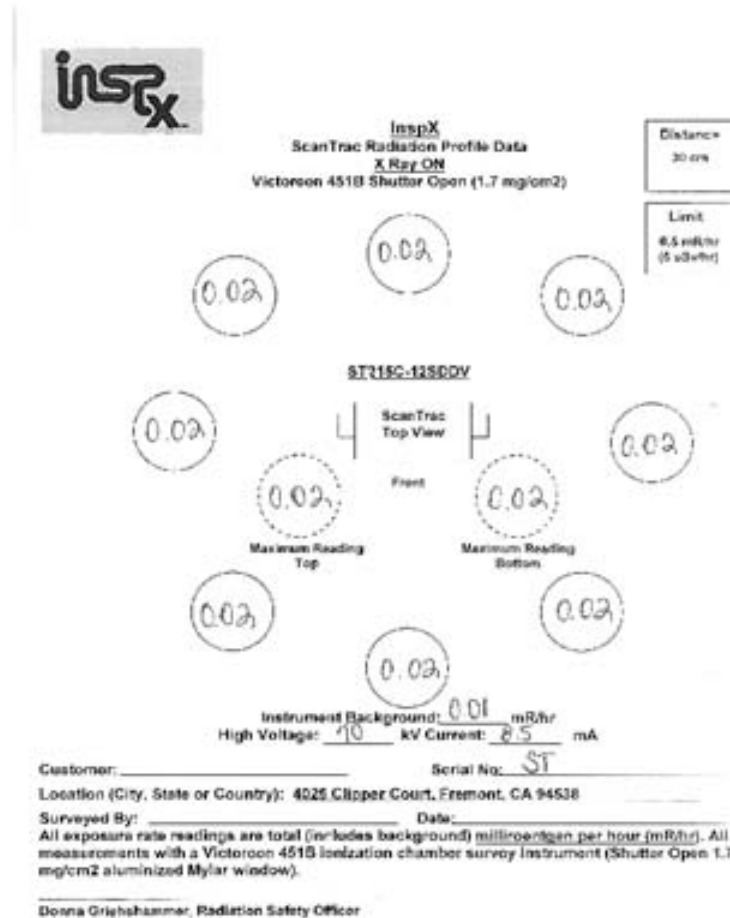
What worker safety issues will I have to deal with?

The most important safety issue to deal with is communication. Overcome Fear / Uncertainty / Doubt with clear communications.

X-ray inspection systems used in the tuna packaging and food processing lines are “closed cabinet systems.” By design, no radiation beyond normal background limits can be present at a distance of 5 cm anywhere around the system.



What worker safety issues will I have to deal with?





What effect will the x-ray have on my product?

None.

The minimal exposure that the product has to the scanning x-rays (both in terms of energy level and time) does not alter the description of a product as “natural” or otherwise as clarified by the FDA and similar authorities.



Where should I be considering locating an x-ray inspection system in my operations?

X-ray inspection locations should reflect your appraisal of risk / reward.

For a first installation, the finished package is a starting point, typically after retorting for cans, pouches and glass jars. At this point any source of foreign material has been entered and the seal put on.

For product inspection, in particular loins, this inspection is best made at the infeed to the filler (as contrasted to packed bags).

Where should I be considering locating an x-ray inspection system in my operations?



The x-ray system installs immediately after the seamer in tight space here as shown in a vegetable canning application. [Note: Rear of inspection assembly is shown.]



This bean canning application was planned from the design of the line and shows the more pristine environment as the cans make their way to the cooker.



What are some basic principles of x-ray inspection that would assist me in locating such a system?

The most important principle is product uniformity. Choose a location where the product (including the package) is as uniform as possible. Elimination of the variability in the package or process greatly enhances the detection of the non-conforming elements.

Also, a narrower dimension to scan through enhances the probability of inspection.

What does an x-ray system cost?

The cost of an x-ray system vary with several factors:

- Power Source
- Tube Design
- Speed
- Number of Beams
- Side View vs. Belt
- Environmental Design
- Application Specific



What does an x-ray system cost?



Examples of tuna applications :

- Pouch system - \$60,000
- Can inspection - \$100,000
- Loin Inspection - \$150,000
- Glass Inspection - \$185,000



What factors are influencing the adoption of x-ray inspection?

Five driving factors:

1. Automation
2. Marketing
3. Risk Management
4. Technology – X-ray
5. Technology – From the Suppliers

What factors are influencing the adoption of x-ray inspection?

A Driving Force – Automation



What factors are influencing the adoption of x-ray inspection?

Automation means:

- Fewer People
- Longer Hours
- Faster Speeds



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What factors are influencing the adoption of x-ray inspection?

A Driving Force – Marketing



Major customers including food chains and warehouse clubs are asking for x-ray. Frequently they give preference to companies using x-ray.

What factors are influencing the adoption of x-ray inspection?

A Driving Force - Risk Management

- **Good Manufacturing Practice (GMP)**
- **HACCP Evolution**
- **Product Recall**
- **Insurance Cost**
- **Customer Relationships and Brand Value**

Metal Contamination Fear Sparks Marie Callender Chicken Soup Recall

Recall - - An Ohio ConAgra plant is voluntarily recalling approximately 271,000 pounds of chicken noodle soup that may be contaminated with metal, the USDA said.

WASHINGTON (Reuters)

HEALTH HAZARD ALERT - DAB ORIGINAL DORTMUNDER PREMIUM LAGER BEER MAY CONTAIN GLASS PARTICLES

OTTAWA, July 18, 2003 - The Canadian Food Inspection Agency (CFIA) is warning restaurants and bars not to serve DAB Original Dortmund Premium Lager Beer as it may contain glass particles. Consumers who may have purchased the affected product should not consume it.

- COLES ONLINE PRODUCT RECALL NOTICE -

CAMPBELL'S CONDENSED SOUP VEGETABLE BEEF, 420 g ITEM CODE: 156983 BATCH CODE: AJ223
(The reason for the recall is due to the presence of foreign matter (pieces of rubber and rubber-coated metal) found in some cans.)

What factors are influencing the adoption of x-ray inspection?

A Driving Force

- Risk Management

- **Good Manufacturing Practice (GMP)**
- **HACCP Evolution**
- **Product Recall**
- **Insurance Cost**
- **Customer Relationships and Brand Value**



StarKist



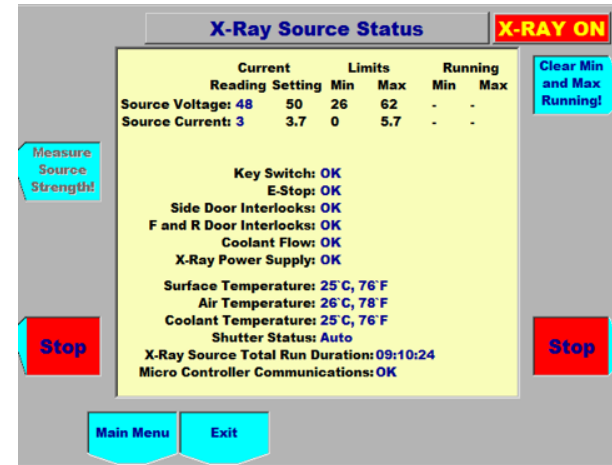
What factors are influencing the adoption of x-ray inspection?

A Driving Force

- New X-ray Technology

Trends:

- Higher Speeds
- Improved Reliability
- Enhanced X-ray Components
- Application Specific Systems
- Communication Advances

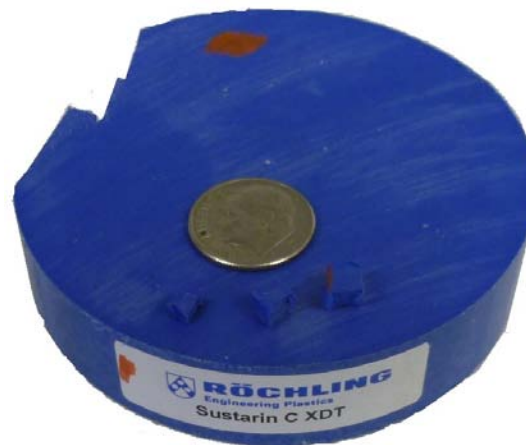


Remote Communication provides means for 24 hour support and improved reliability.

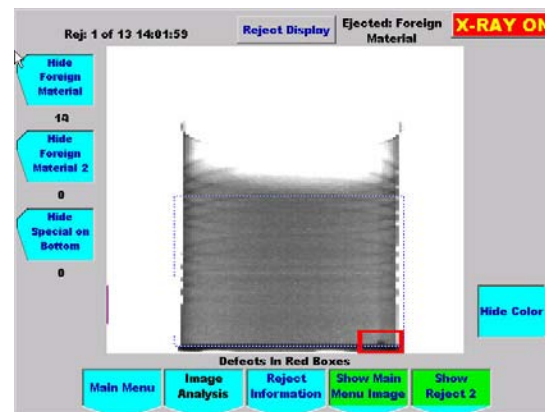
What factors are influencing the adoption of x-ray inspection?

A Driving Force

- Technology from the suppliers. Working within the laws of Physics.



The plastic sample above has been developed to replace plastics commonly used in the food industry that are not x-ray detectable. The result is as shown at right. Machine components and materials used in the food processing industry such as safety glasses will increasingly be available as X-ray Detectable (XDT)



Summary Comments

X-ray inspection will increasingly become the norm for GMP and similar standards.

There is **x-ray** and there is *x-ray*. Making an x-ray inspection does not mean the same thing across all systems and applications. Having a system with a red light can be making an x-ray inspection. X-ray inspection as presented today means getting the full benefit of x-ray inspection... detecting bones in tuna for example and glass in glass.

X-ray inspection as presented is just like so many parts of the tuna industry.. A joint venture... a partnership. Good results follow from the supplier and the tuna packer working together. A commitment by the packer to quality conveying coupled with training and maintenance will provide you with results that you had no way of knowing were possible.

X-ray inspection is a new look, and is a first look in almost all cases. If you do not look, you will never see.

Finally, a familiar adage, but applicable. If you cannot measure, you cannot manage.

Questions?

