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Rechargeable vs. Alkaline Batteries in Combustible Gas Indicators

A Five-Year Cost Comparison per Instrument



Executive Summary

A SENSIT GOLD 2 combustible gas indicator used on daily 8-hour shifts goes through about 375 alkaline C-cells a year. At $1.50 per cell, that is $562.50 per instrument per year in batteries alone, before anyone counts the time spent swapping them. The SENSIT GOLD 3 runs 12 hours on one charge of its rechargeable battery, which covers a full shift with margin and removes the recurring battery purchase.

This paper sets out the arithmetic in full, including the costs on the rechargeable side. Every assumption is stated so a utility can replace it with its own numbers.

Key findings, per instrument, over five years:

- **Alkaline cells:** can be 125 sets (375 C-cells) a year, or $2,812.50 over five years.
- **Swap labor:** about 10.4 hours a year at 5 minutes per swap, or $1,562.50 over five years at a $30/hour loaded rate.
- **Net avoided cost with the GOLD 3:** $4,375 when the original battery is used for the full five years, as it has for many SENSIT customers.
- **Waste removed:** about 26 kg of spent alkaline cells per instrument per year, or roughly 2.6 tonnes a year across a 100-instrument fleet.

Downtime, inventory and disposal handling are discussed but not added to these totals, so the figures above are a floor rather than a ceiling.

Why Battery Cost Matters for Gas Utilities

How much do batteries cost for a gas detector each year?
For a GOLD 2 on 8-hour shifts, about $562.50 a year in alkaline cells, plus about $312.50 in swap labor. The cost is easy to overlook because each purchase is small and comes out of consumables, not capital. Across a fleet and a five-year service life, it becomes one of the larger running costs of owning a handheld instrument.

Combustible gas indicators work hard at gas utilities. Leak investigations, pinpointing, odor calls and confined-space checks are the instrument's day-to-day work. An instrument that runs most working days is an instrument that consumes batteries most working days.

The question for an operations leader is not the price of one battery. It is what the power source costs over the life of the instrument, including the people who buy, stock, swap and dispose of the cells.

How Instrument Batteries Behave in the Field

Runtime ratings are typical values, not guarantees. Both alkaline and rechargeable cells deliver less energy when they are worked hard or used in the cold. Knowing why helps crews plan their day and helps supervisors read a runtime spec correctly.

Alkaline Cells
An alkaline C-cell is a single-use zinc/manganese dioxide cell with a nominal voltage of 1.5 V. Duracell states for its Procell PC1400 C-cell that delivered capacity depends on the applied load, operating temperature and cut-off voltage so no single mAh figure tells you how long an instrument will run.

In practice this means two things. First, the 18-hour figure for a GOLD 2 is a typical runtime with good cells in moderate conditions. Second, each individual battery may not run to the last minute. They get replaced early, and the remaining energy goes in the bin.

Why cell quality matters
Not all C-cells perform the same. SENSIT ships every alkaline-powered instrument with Duracell Procell C-cells and recommends professional-grade batteries for replacements, not generic or mixed cells, to keep runtime and performance consistent. Cheaper cells can lower the per-cell price in this model but may shorten runtime and increase swap frequency, which raises the labor line.

Field note: batteries and hazardous-location instruments
Instruments certified for use in hazardous locations may permit only specific battery types. Before fitting replacement cells, check the instrument label and manual for approved batteries. Using a non-approved cell can affect the instrument's certification. When in doubt, use the cell type the instrument shipped with.

Rechargeable lithium-ion batteries
A rechargeable lithium-ion battery is charged between shifts instead of replaced. The GOLD 3 runs 12 hours on a charge, so a crew working an 8-hour shift finishes with roughly a third of the charge still available.

Lithium-ion batteries also lose capacity in the cold, and charging at low temperature can damage the lithium plating which degrades the battery. The practical rule for crews is simple: charge the instrument indoors or in a warm cab, not in an unheated truck bed overnight in winter.

The SENSIT Approach: Rechargeable Power on the GOLD 3

The SENSIT GOLD 3 ships with a rechargeable battery and charger. A charge lasts 12 hours, and the charging method helps encourage an end-of-shift habit: instrument back in the charger, ready the next morning. There is no battery stock to manage on the truck and no spent cells to collect.

Battery life is a question buyers ask. What SENSIT can report is field experience: customers have used the same GOLD 3 battery for more than five years. To keep the comparison conservative, this paper also models a case in which one replacement battery is bought during the five years at an assumed $400.

The GOLD 2 remains a dependable alkaline-powered instrument, and many utilities run both. The choice is about operating cost and handling, not about whether the GOLD 2 does its job.

The Cost Model

Assumptions

Table 1

PARAMETER	VALUE	BASIS
GOLD 2 battery	3 x C-cell alkaline	SENSIT specification
GOLD 2 runtime	~18 hours per set	SENSIT specification
GOLD 3 runtime	12 hours per charge	SENSIT specification
Shift length	8 hours	Model assumption
Working days per year	250	Model assumption (52 weeks x 5, less holidays)
C-cell price	$1.50 per cell ($4.50 per set)	Model assumption
Time per battery swap	5 minutes	Model assumption
Loaded labor rate	$30 per hour	Model assumption
Replacement rechargeable battery	$400 (illustrative)	Model assumption for the conservative case
C-cell weight	69 g	Duracell PC1400 datasheet

How many C-cells does a GOLD 2 use per year?
About 375, or 125 sets, on 8-hour shifts. There are two ways to count, and this paper shows both.

- Runtime minimum: 250 shifts × 8 hours = 2,000 operating hours. 2,000 ÷ 18 hours per set = 111 sets a year ($500). This assumes every set is run to the last minute, which rarely happens.
- Field practice: an 18-hour set covers two full 8-hour shifts with 2 hours left, which is not enough for a third shift. Crews swap at the start of every second shift: 250 ÷ 2 = 125 sets a year ($562.50).

The field-practice figure is used for the rest of the paper. Replace this assumption with your own run time figures.

Alkaline cost per instrument

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Table 2

COST LINE	FORMULA	PER YEAR	FIVE YEARS
Alkaline cells	125 sets x $4.50	$562.50	$2,812.50
Swap labor	125 swaps x 5 min = 10.4 h x $30	$312.50	$1,562.50
Total alkaline-related cost	**Cells + swap labor**	**$875.00**	**$4,375.00**

Rechargeable cost per instrument
The GOLD 3 battery and charger ship with the instrument, so there is no recurring consumable. Charging happens at end of shift and is not costed as labor here. Charging electricity for a handheld instrument is small next to the figures in this paper and is excluded. The only cost in a conservative model is battery replacement.

Net five-year avoided cost

Worked example: one instrument, five years
Alkaline cells: 125 sets × $4.50 × 5 years = $2,812.50
Swap labor: 125 swaps × 5 min × 5 years = 52.1 hours × $30 = $1,562.50
Total alkaline-related cost: $4,375.00

Net avoided cost if the original battery lasts five years: $4,375
Net avoided cost with one $400 replacement battery: $4,375 − $400 = $3,975

Cells only, ignoring labor: $2,812.50 if the original battery lasts, or $2,412.50 with one replacement

On these assumptions the GOLD 3 avoids roughly $2,400 to $4,400 per instrument over five years, depending on whether labor is counted and whether a replacement battery is needed. Per year, the avoided cost is $875 with labor or $795 after spreading one $400 battery over five years.

What if our assumptions are different?
Battery price and working days vary by utility. Bulk contracts can bring C-cell prices below $1.50, and some crews work fewer days on instrument duty. Table 4 shows annual cell cost per GOLD 2 across a realistic range.

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Table 3

PRICE PER C-CELL	200 DAYS/YEAR	250 DAYS/YEAR	260 DAYS/YEAR
$1.00 ($3.00 per set)	$300	$375	$390
$1.50 ($4.50 per set)	$450	$562.50	$585
$2.00 ($6.00 per set)	$600	$750	$780

Shift length matters too. Table 4 uses the runtime minimum (operating hours ÷ 18), so it understates real use. Longer shifts raise alkaline spend in direct proportion, while the GOLD 3 still covers shifts of up to 12 hours on a single charge.

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Table 4

SHIFT LENGTH	OPERATING HOURS/YEAR	SETS/YEAR (MIN.)	CELL COST/YEAR	GOLD 3 CHARGES PER SHIFT
6 hours	1,500	83	$375	1
8 hours	2,000	111	$500	1
10 hours	2,500	139	$625	1
12 hours	3,000	167	$750	1

Fleet scale

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Table 5

FLEET SIZE	C-CELLS PER YEAR	SPENT CELLS BY WEIGHT PER YEAR	CELLS + LABOR PER YEAR	NET FIVE-YEAR AVOIDED COST
25 Instruments	9,375	~0.65 t	$21,875	$99,375
100 Instruments	37,500	~2.6 t	$87,500	$397,500
500 Instruments	187,500	~12.9 t	$437,500	$1,987,500

Side-by-side comparison

Table 6

DIMENSION	SENSIT GOLD 2 (ALKALINE)	SENSIT GOLD 3 (RECHARGEABLE)	SOURCE
Power source	3 x C-cell alkaline; ships with Duracell Procell	Rechargeable lithium-ion battery and charger, included	SENSIT
Runtime	~18 hours per set	12 hours per charge	SENSIT
8-hour shifts covered	2 per set, then swap	1 per charge, ~4 hours spare	Calculated
Batteries bought per year	~125 sets (375 cells)	None; replacement as needed	Calculated
Battery cost per year	$562.50	$0 to $80 (one $400 battery spread over five years)	Calculated
Battery handling labor per year	~10.4 hours ($312.50)	End-of-shift charging; not costed	Calculated
Spent batteries per year	~25.9 kg	None until battery end-of-life	Duracell
End-of-life handling	Trash allowed in most states; banned from trash in California	Likely hazardous waste; businesses can manage as universal waste	EPA; DTSC

Costs This Model Does Not Count

Several real costs are left out of the totals because they vary too much between utilities to estimate fairly. Each one adds to the alkaline side.

Downtime
A set that runs flat mid-task sends a crew member back to the truck. As an illustration only: if each event costs 30 minutes at $30 an hour, one event a month adds $180 a year per instrument. Your own incident data will give a better number.

Procurement and inventory
Someone orders, receives, stores and distributes about 125 sets per instrument per year, and each truck carries a spare stock. Cells kept in hot or freezing vehicles can also lose performance before use, since Duracell recommends storage between 5 °C and 30 °C.

Disposal and compliance
Federally, EPA says alkaline batteries can be put in household trash in most communities, while recommending recycling where available. State rules differ. California prohibits putting any battery in the trash and manages batteries as universal waste, and other states and localities set their own requirements. Rechargeable lithium-ion batteries are not trash-safe anywhere: EPA states most are likely hazardous waste when discarded and recommends businesses manage them under the federal universal waste rules. The GOLD 3 still creates an end-of-life item, but one battery every several years instead of hundreds of cells a year.

What This Means in the Field

For field crews
The start-of-day battery check goes away. A GOLD 3 that went into the charger at the end of yesterday's shift starts today with 12 hours available, so an 8-hour day, or a 10-hour day after an emergency call, finishes without a swap. Crews stop carrying spare C-cells and stop collecting dead ones. In winter, charge the instrument indoors or in a warm cab.

For supervisors
Battery-related interruptions drop out of the day, and so does the job of keeping trucks stocked with cells. A crew of ten GOLD 2 users swaps about 1,250 sets a year; with the GOLD 3 that becomes a charging routine. The main change to manage is the habit: instruments go back on charge at the end of every shift.

For operations and procurement leaders
A recurring consumable line turns into a battery that has lasted more than five years in customer use. On the assumptions in this paper, a 100-instrument fleet avoids about $56,000 a year in cells and about $31,000 in swap labor, and stops generating about 2.6 tonnes of spent batteries a year, which counts toward waste-reduction and sustainability reporting. To test the case, pull 12 months of C-cell purchase records, count active instruments, and apply your loaded labor rate to the formulas in Table 2.

Summary

Alkaline power is a small cost repeated thousands of times. For a single GOLD 2 on 8-hour shifts, it adds up to about $875 a year in cells and swap labor. The GOLD 3's 12-hour rechargeable battery removes that recurring cost. Even after budgeting for one $400 replacement battery, the net avoided cost is about $3,975 per instrument over five years, and more where batteries last as long as they have in the field.

The next step is to run the numbers on your own fleet. Start with last year's battery purchases and your active instrument count, then talk to your SENSIT representative about GOLD 3 pricing and a payback figure for your operation.

Frequently Asked Questions

How many batteries does a SENSIT GOLD 2 use per year?
About 125 sets of three C-cells, or 375 cells, for an instrument used on 8-hour shifts 250 days a year. That assumes crews replace the set every second shift. Running every set to the last minute would lower this to about 111 sets.

How long does the SENSIT GOLD 3 battery last on one charge?
12 hours. That covers an 8-hour shift with about 4 hours to spare and also covers 10-hour shifts on a single charge.

How long does the GOLD 3 rechargeable battery last before it needs replacing?
Customers have used the same GOLD 3 battery for more than five years in the field. This paper's conservative case assumes one replacement in five years.

Are rechargeable gas detectors cheaper to run than alkaline ones?
In this comparison, yes. A GOLD 3 avoids about $2,400 to $4,400 per instrument over five years compared with a GOLD 2 on alkaline cells, depending on whether swap labor is counted and whether a replacement battery is needed.

What batteries should I use in an alkaline battery SENSIT instrument?
SENSIT ships alkaline instruments with Duracell Procell C-cells and recommends professional-grade batteries for replacements. Check the instrument label and manual for approved battery types, especially on instruments certified for hazardous locations.

Can I throw used alkaline batteries in the trash?
In most U.S. communities, yes, according to EPA, though EPA recommends recycling. California bans batteries from the trash, and some other states and localities have their own rules. Check your state requirements.

How should used lithium-ion instrument batteries be disposed of?
Not in the trash. EPA states most lithium-ion batteries are likely hazardous waste when discarded and recommends businesses manage them as universal waste through a battery recycler or approved handler.

Does cold weather affect gas detector batteries?
Yes, for both types. Alkaline cells deliver less capacity in the cold. Lithium-ion batteries also lose capacity in the cold and should not be charged below freezing, so charge instruments indoors or in a heated cab.

Terms and Definitions

Alkaline battery: A single-use battery using zinc and manganese dioxide. Nominal voltage 1.5 V per cell.

C-cell (LR14): A standard battery size. The IEC designation for an alkaline C-cell is LR14.

CGI (combustible gas indicator): A handheld instrument that detects and measures flammable gases such as methane, used for leak investigation and pinpointing.

Cut-off voltage: The voltage below which an instrument stops running on a battery. A higher cut-off leaves more energy unused in the cell.

Cycle life: The number of charge and discharge cycles a rechargeable battery delivers before its capacity falls below a set level.

Delivered capacity: The energy a battery actually provides under given load, temperature and cut-off conditions, usually stated in mAh.

Hazardous location: An area where flammable gas or vapor may be present. Instruments used there may need certification that limits approved battery types.

Lithium-ion (Li-ion): A rechargeable battery chemistry common in portable instruments.

Lithium plating: Deposition of metallic lithium on a lithium-ion battery's anode, made more likely by charging at low temperature. It reduces capacity and can raise safety risk.

Loaded labor rate: Hourly wage plus benefits and overhead; the full cost of an hour of an employee's time.

mAh (milliampere-hour): A unit of battery charge capacity.

Payback period: The time it takes for avoided operating costs to equal a difference in purchase price.

TCO (total cost of ownership): Purchase price plus all running costs over an asset's life.

Universal waste: A federal hazardous waste category (40 CFR Part 273) with streamlined handling rules for common items such as batteries.