Accelerating Site Closure and Reducing Liabilities

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Environmentally impaired properties in endless cycles of remediation and investigation with no viable exit plan can be resolved

The Challenge

Many of our clients are adapting to the reality that, despite repeated efforts to find a new technology, contracting strategy, or innovative incentive structure, many environmentally impacted sites have no viable exit plan. This is most problematic for sites with free phase, complex geology, and unachievable standards. Expenditures continue, year after year, with little or no societal benefit or improvement in water security, land use, or consideration of created problems such as emission of greenhouse gases and other sustainability issues.

Socio-political issues underlie the challenge. Regulators and the public are inherently resistant to any remedial plan that "gives up" and leaves residual contamination in place above soil and groundwater trigger values. The determination of the desired endpoint of remedial activities and acceptability of residual contamination continue to be a challenge and a subject of discussion.

In our experience of complex sites, there are four conditions that tend to lock in recurring cycles of investigation and remedial activities:

* **Status Quo Inertia:** Continuation of existing engineered systems is the path of least resistance.
* **Conflicting/unrealistic objectives:** Contaminant mass removal or hydraulic control cannot achieve unrealistic targets.
* **Siloed Responsibilities:** Decision Makers seldom are accountable for ancillary impacts.
* **Distrust:** Trust is essential, but skepticism over motives creates barriers.

Breaking the Endless Cycle

At complex sites, exit can be accelerated by enhancing natural systems while simultaneously minimizing disruptive, non-productive human intervention. Such a change in emphasis can be difficult for stakeholders to embrace. It requires a commitment to educating, engaging, and convincing stakeholders that natural resource security and risk pathway protection can be achieved without long term extensive intervention. Common default measures of success such as hydraulic control, mass removal, and achieving trigger values often provide little to no net societal or environmental benefit, yet extensive engineered intervention continues year after year with no exit on the horizon.

A disciplined approach and message are needed to break this endless cycle and remove properties and liabilities from balance sheets. Primary stakeholders must take a disciplined approach to proactively build trust. This approach rests on the four pillars shown in Figure 1.

This approach is being pursued by several of our clients that grew increasingly frustrated with the inability to remove properties and liabilities off their balance sheets. It has been tested and demonstrated at many sites involving savings in the tens of millions of pounds for our clients.

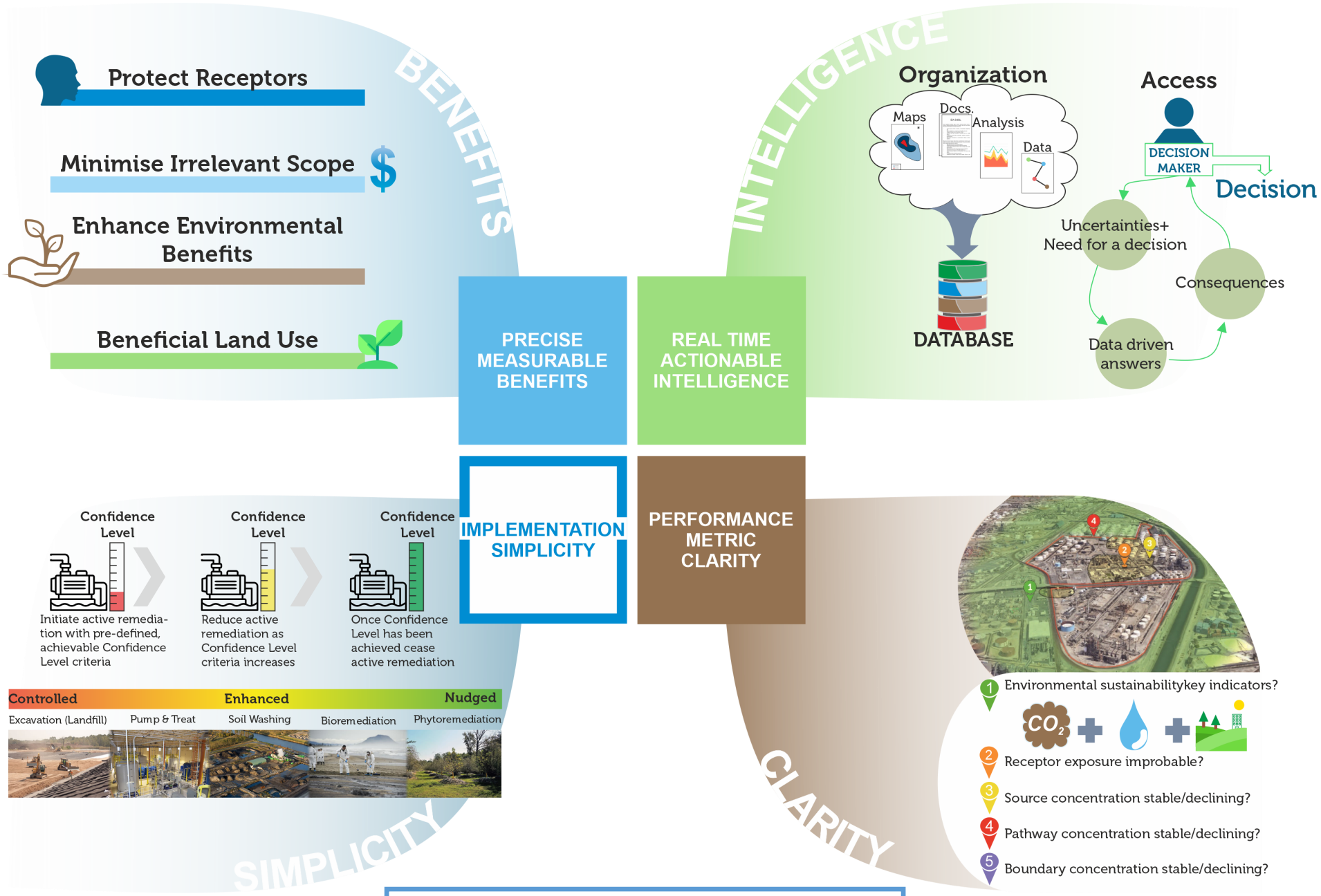

Figure 1: The four pillars

Our approach refocuses technical practicability from what is *possible* to what is *best* for the public interest

Precise Measurable Benefits

Often, the overriding goal in making site action decisions is limited to reducing contamination. The goals can be broadened, however, to create a more comprehensive picture of environmental benefit. The four metrics shown in Figure 2 balance mass removal with social/environmental benefits relevant to stakeholders. With few exceptions, the actual receptor issue is vapor intrusion or migration of a contaminant plume to a groundwater supply or surface water body. The receptor issue in all but a few cases can be mitigated with minimal engineering and/or institutional controls through land use planning and practical institutional controls.

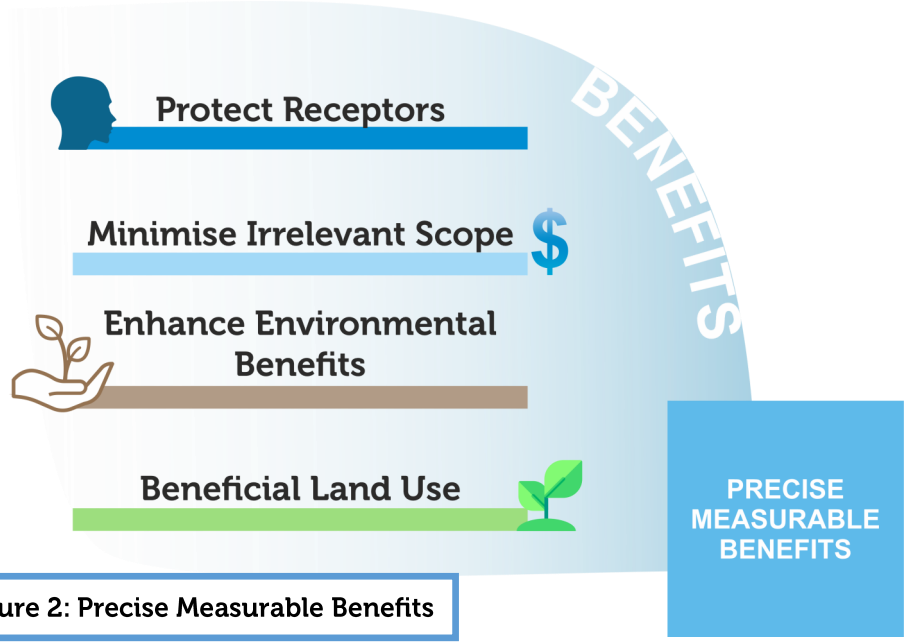

Figure 2: Precise Measurable Benefits

The three other metrics provide the public with real, measurable, and visible benefit. Eco- engineering/supplemental environmental projects can be deployed to improve environmental metrics such as water security. These supplemental projects can be achievable, provide greater benefit, and are less costly than achieving trigger values, mass removal, or hydraulic control. Examples of such projects that provide measurable water security enhancement are treatment wetlands, riparian or watershed restoration, and smart water systems to reduce water waste or use.

Real Time Actionable Intelligence

A negotiation team should have absolute mastery of data and knowledge in order to communicate effectively throughout stakeholder engagement and negotiations. Too often, data moves through multiple levels of analytics before it reaches decision makers. Highly qualified discipline specialists may be involved at each level, but each has a siloed perspective and inputs his or her understanding of relevancy before moving knowledge to the next level. By the time analysis reaches an actual decision maker, the multi-dimensional data is constrained into a highly processed and static form, skewed by other agendas and biases.

This challenge can be addressed with:

1. Negotiation teams with all members, including senior negotiators, experienced in advanced data management and analytical tools.

Access to the right information, at the right time, and in the right format

2. Utilization of tools which provide all members with access to the full stack of data in formats that are easy to navigate. This increase in knowledge access and transfer can be accomplished with databases, GIS, web-based data browsers, and real-time analytics.
3. Communication simplicity designed for decision makers.

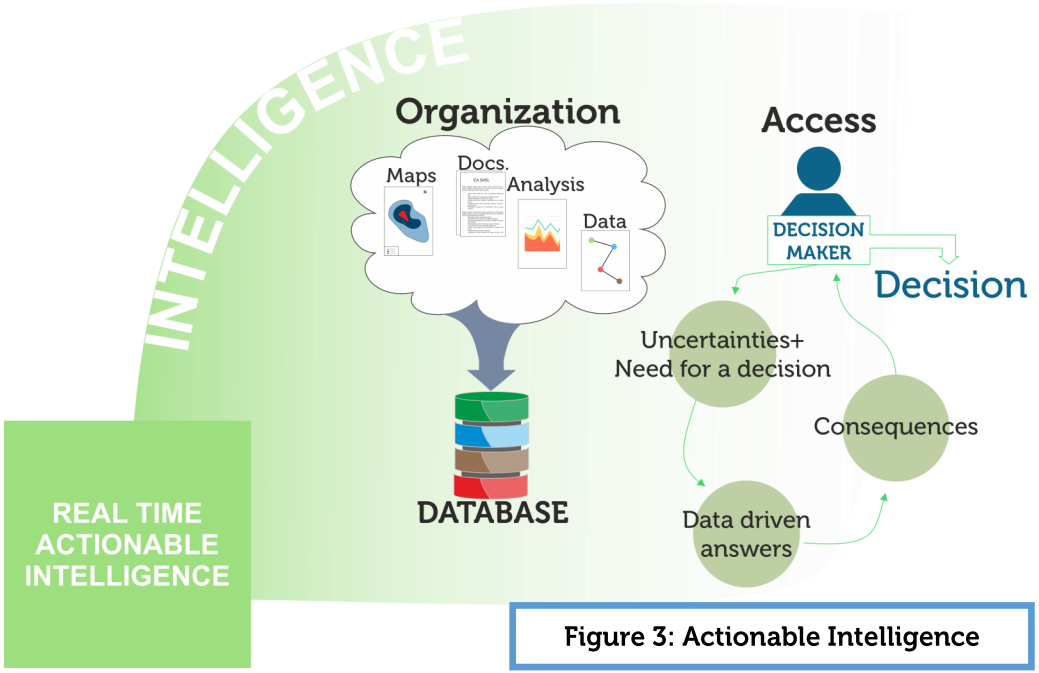

Figure 3: Actionable Intelligence

Performance Metric Clarity

Practical, clear, and measurable metrics for determining success should be introduced as early as possible. However, most problematic sites must deal with existing activity and regulatory requirements such as Consent Orders (CO) and Records of Decision (ROD). Status quo bias should not limit initiatives to reconsider the entirety of remediation options.

Trigger values are a reality that must be addressed. However, trigger values are surrogate measures of broader societal goals. They are frequently counterproductive, forcing wasteful expenditures with little to no progress toward the goals they were established to achieve. Performance metric clarity can help to demonstrate that societal goals for protecting health and resources (water, air, soil) can be accomplished, frequently much more effectively, with adaptations that modify trigger values constraints. Performance metrics should be developed internally and introduced methodically to agencies.

The metrics establish what data is needed to answer the following threshold questions, and what metrics require intervention.

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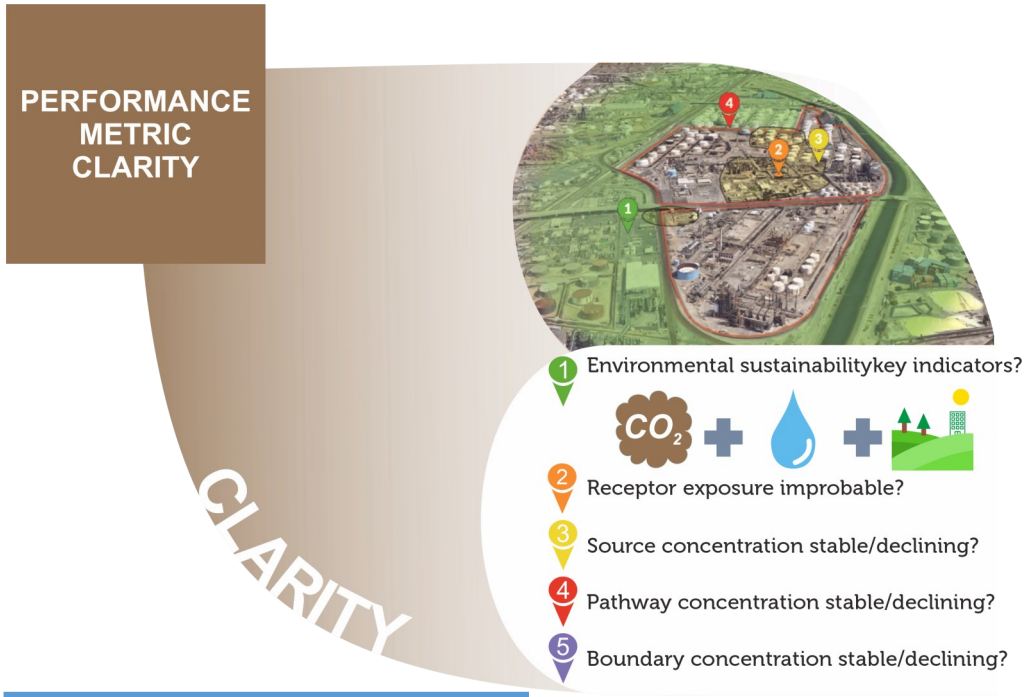

Figure 4: Performance Metric Clarity

What are the key indicators of environmental sustainability?

Incorporate key indicators of sustainability and resiliency such as quantity of protected water, greenhouse gas emissions, restoration of environmental systems, and economic benefit from land use.

Is receptor exposure improbable?

Consistent focus on empirical data and actual receptors, realistic water use rather than speculative overly conservative assumptions; empirical vapor intrusion measurement rather than theoretical; third party trespass/nuisance mitigation rather than impossible restoration.

Is the source concentration stable or declining?

Empirical demonstration that source contaminant concentrations are stable or declining as opposed to mass removal or target ARAR concentrations.

Are pathway concentrations stable or declining?

Empirical time series criteria that the trajectory of contaminant concentrations are stable or declining as opposed to target trigger values.

Are boundary concentrations stable or declining?

Empirical time series criteria that the trajectory of contaminant concentrations upgradient of a receptor location are stable or declining as opposed to mass removal, trigger values, or reverse hydraulic/pressure gradients.

The foundation for performance simplicity is minimization of complex and disruptive engineered intervention that has no practical exit criteria

Implementation Simplicity

Implementation simplicity is replacement of active engineered systems with passive measures to the maximum extent possible. Any active remediation or mass removal should be employed with precise criteria that allows the remedial systems to be diminished and ultimately discontinued based on receptor exposure control.

We favour using engineered intervention only to nudge and enhance natural processes. Passive systems such as phytoremediation, phytopumping, enhanced degradation or enhanced dilution and attenuation, green and sustainable remediation are all practical and economical. Implementation simplicity can include one or more of the following elements:

Baseline strategy

Maximize the control of risk pathways with land use, institutional control, and/or dilution/attenuation as the first line of defense against present or future completion of a risk pathway.

Minimize Engineered Intervention

Utilize active engineered intervention (i.e. groundwater pump and treat [P&T] soil vapor extraction [SVE], in situ chemical oxidation [ISCO], etc.) only as needed to obtain a defined factor of safety and only with precise, clearly achievable termination criteria.

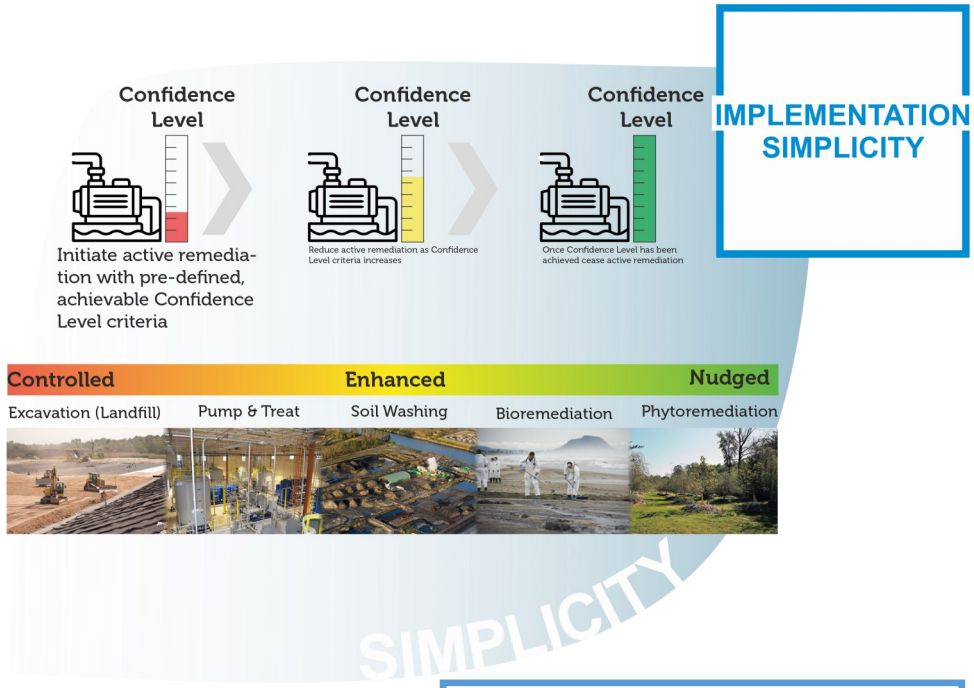

Figure 5: Implementation Simplicity

Maximize Passive Eco-engineering

Focus on supporting ecosystems as a replacement of engineered interventions:

* Biodegradation,
* Bio-stabilization,
* Microbial transformation,

We favour engineered intervention only to nudge and enhance natural processes

* Phyto-pumping, phyto-stablization, phyto-sequestration, phyto-volatilization,
* Enhanced infiltration,
* Natural filtration,
* Smart system hydraulic gradient management.

Case Studies

Each of the four pillars of the *Accelerating Site Closure and Reducing Liabilities* approach we described above is supported by a case study that demonstrates its applicability. The case studies can be found on this link http://uk.newfields.com/downloads/ and include:

The Hickson & Welch site in Castleford, UK demonstrating how Precise Measurable Benefits can reduce costs while protecting the main receptor.

Our work in the London Olympics site, UK, demonstrating the application of Real Time Actionable Intelligence to support decision making in the redevelopment of a complex site.

The Mersey Gateway Bridge Project in Runcorn, UK where the development of precise metrics helped to move forward the project due to a better understanding of its uncertainties regarding cost and time.

The Abeerden Pesticide Dump Site in the US where the use of passive nature based solutions achieved same or greater performance than nearby sites, with significant cost reduction in O&M costs.

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