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DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Parts 1915 and 1926

[Docket No. OSHA–H005C–2006–0870]

RIN 1218–AD29

Occupational Exposure to Beryllium and Beryllium Compounds in Construction and Shipyard Sectors

AGENCY: Occupational Safety and Health Administration (OSHA), Labor.

ACTION: Final rule.

SUMMARY: OSHA is amending its existing construction and shipyard standards for occupational exposure to beryllium and beryllium compounds to clarify certain provisions and simplify or improve compliance. These changes are designed to accomplish three goals: to more appropriately tailor the requirements of the construction and shipyards standards to the particular exposures in these industries in light of partial overlap between the beryllium standards' requirements and other OSHA standards; to aid compliance and enforcement across the beryllium standards by avoiding inconsistency, where appropriate, between the shipyards and construction standards and recent revisions to the general industry standard; and to clarify certain requirements with respect to materials containing only trace amounts of beryllium. This final rule does not affect the general industry beryllium standard.

DATES: This rule is effective [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES: For purposes of 28 U.S.C. 2112(a), OSHA designates Mr. Edmund C. Baird, Associate Solicitor of Labor for Occupational Safety and Health, to receive petitions for review of the final rule. Contact the Associate Solicitor at the Office of the Solicitor, Room S-4004, U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 20210; telephone: (202) 693-5445.

Copies of this Federal Register document and news releases: Electronic copies of these documents are available at OSHA's webpage at <https://www.osha.gov>.

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I. Background

On January 9, 2017, OSHA published its final rule *Occupational Exposure to Beryllium and Beryllium Compounds* in the *Federal Register* (82 FR 2470). The final rule established three comprehensive health standards to protect workers from occupational exposure to beryllium and beryllium compounds in the general industry (29 CFR 1910.1024), construction (29 CFR 1926.1124), and shipyards (29 CFR 1915.1024) sectors. In the final rule, OSHA concluded that employees exposed to beryllium and beryllium compounds at the preceding permissible exposure limits (PELs) were at significant risk of material impairment of health, specifically chronic beryllium disease (CBD) and lung cancer. The agency further determined that limiting employee exposure to an 8-hour time-weighted average (TWA) PEL of 0.2 $\mu\text{g}/\text{m}^3$ would reduce this significant risk to the maximum extent feasible. Therefore, the 2017 final rule adopted a TWA PEL of 0.2 $\mu\text{g}/\text{m}^3$. In addition to the revised PEL, the 2017 final rule established a new short-term exposure limit (STEL) of 2.0 $\mu\text{g}/\text{m}^3$ over a 15-minute sampling period and an action level of 0.1 $\mu\text{g}/\text{m}^3$ as an 8-hour TWA, along with a number of ancillary provisions intended to provide additional protections to employees. The ancillary provisions included requirements for exposure assessment, methods for controlling exposure, respiratory protection, personal protective clothing and equipment, housekeeping, medical surveillance, hazard communication, and recordkeeping that are similar to those found in other OSHA health standards. The 2017 final rule went into

effect on May 20, 2017, and OSHA began enforcing the PEL and STEL in the construction and shipyard sectors on May 11, 2018. See Updated Interim Enforcement Guidance for the Beryllium Standards, available at <https://www.osha.gov/laws-regs/standardinterpretations/2018-12-11>.

On June 27, 2017, based on stakeholder feedback and a review of applicable existing standards, OSHA published a notice of proposed rulemaking (NPRM) proposing to revoke the ancillary provisions for both the construction and shipyards standards while retaining the new lower PEL of 0.2 µg/m³ and STEL of 2.0 µg/m³ for those sectors (82 FR 29182).¹ OSHA stated in the proposal that it was also considering extending the compliance dates in the January 9, 2017, final rule by a year for the construction and shipyard standards. OSHA reasoned that this potential extension would give affected employers additional time to come into compliance with the final rule's requirements, which could be warranted by the uncertainty created by the proposal. OSHA also stated in the proposal that it would not enforce the construction and shipyard standards without further notice while the rulemaking was underway.²

On May 7, 2018, OSHA issued a direct final rule (DFR) adopting a number of clarifying amendments to the general industry beryllium standard to address the application of that standard to materials containing trace amounts of beryllium (83 FR 19936). The DFR amended the text of the general industry standard to clarify OSHA's intent with respect to certain terms in the standard, including the definition of beryllium

¹ For a full discussion of the events leading to the proposed rule, see the preamble to the 2017 NPRM (82 FR at 29185-88).

² Subsequently, in March 2018, OSHA stated that it would begin enforcing the PEL and STEL on May 11, 2018 (see Memorandum for Regional Administrators, Delay of Enforcement of the Beryllium Standards under 29 CFR 1910.1024, 29 CFR 1915.1024, and 29 CFR 1926.1124, Mar. 2, 2018, available at <https://www.osha.gov/laws-regs/standardinterpretations/2018-03-02>).

work area, the definition of emergency, and the meaning of the terms dermal contact and beryllium contamination. The DFR also clarified OSHA's intent with respect to provisions for disposal and recycling and with respect to provisions that the agency intended to apply only where skin can be exposed to materials containing at least 0.1 percent beryllium by weight. The DFR became effective on July 6, 2018, because OSHA did not receive significant adverse comment in response to the DFR (see 83 FR 1045).

On December 11, 2018, OSHA published another NPRM to modify several of the general industry beryllium standard's definitions, along with the provisions for methods of compliance, personal protective clothing and equipment, hygiene areas and practices, housekeeping, medical surveillance, communication of hazards, and recordkeeping (83 FR 63746). OSHA reasoned in part that the proposed modifications would provide clarification and simplify or improve compliance. OSHA recently finalized this proposal in a final rule published on July 14, 2020 (85 FR 42582).

On September 30, 2019, OSHA issued a final rule in which the agency declined to revoke the ancillary provisions of the construction and shipyards standards as proposed in the June 27, 2017 NPRM (84 FR 51377). Based on comments received and the record as a whole, the agency determined that there is not complete overlap in protections between the beryllium standards' ancillary provisions and existing standards applicable to these sectors. Thus, revoking all of the ancillary provisions and leaving only the PEL and STEL would be inconsistent with OSHA's statutory mandate to protect workers from the demonstrated significant risks of material impairment of health resulting from exposure to beryllium and beryllium compounds. However, after careful review, OSHA determined that some revisions to the construction and shipyards standards were

appropriate. To give the agency time to finalize a new proposal with these more limited changes to the construction and shipyards standards, the final rule delayed the compliance dates for all ancillary provisions of these standards until September 30, 2020. The final rule did not impact the PEL or STEL, which OSHA has been enforcing since May 11, 2018.

On October 8, 2019, OSHA published the proposal being finalized here (84 FR 53902). In the NPRM, the agency proposed several revisions to the ancillary provisions of the construction and shipyard standards to more appropriately tailor the standards to these industries, to align certain provisions with recent changes to the general industry standard, and to clarify OSHA's intent with respect to materials containing trace amounts of beryllium. The NPRM proposed revisions to the paragraphs for definitions, methods of compliance, respiratory protection, personal protective clothing and equipment, hygiene areas and practices, housekeeping, medical surveillance, hazard communication, and recordkeeping. In developing its proposal, OSHA considered relevant comments received in response to the June 2017 construction and shipyards proposal, as well as general industry stakeholder input that led to the 2018 general industry DFR. In addition, OSHA proposed some revisions to align with changes proposed in the December 12, 2018 general industry NPRM (83 FR 39351).

OSHA consulted with the Advisory Committee on Construction Safety & Health (ACCSH) regarding this proposal on September 9, 2019. ACCSH recommended that OSHA proceed with the proposal to "revise the beryllium standard for construction to ensure that the ancillary provisions are tailored to the construction industry and align with

the general industry standard, where appropriate,” and unanimously recommended that OSHA do so as soon as possible (see Document ID OSHA-2018-0012-0125, Tr. 62-67).

OSHA requested comments on the proposed changes and provided stakeholders 30 days to submit comments. In addition, OSHA held a public hearing on the proposal on December 3, 2019, where the agency heard testimony from several stakeholders (see Document ID 2222; 2223). Participants who filed notices of intention to appear at the hearing were permitted to submit additional evidence and data relevant to the proceeding for a 44-day period following the hearing. That period ended on January 16, 2020. The record remained open for an additional 15 days, until January 31, 2020, for the submission of final briefs, arguments, and summations. OSHA received twenty-five timely comments during this rulemaking by the close of the last post hearing comment period of January 31, 2020.

OSHA estimates that these changes will lead to total annualized cost savings of \$2.5 million at a 3 percent discount rate over 10 years; at a discount rate of 7 percent over 10 years, the annualized cost savings would be \$2.6 million. OSHA has determined that these changes will maintain safety and health protections for workers, while facilitating compliance with the standards and yielding some cost savings.

This rule is not an Executive Order (EO) 13771 regulatory action because this rule is not significant under EO 12866. Pursuant to the Congressional Review Act (5 U.S.C. 801 et seq.), the Office of Information and Regulatory Affairs designated this rule not a “major rule,” as defined by 5 U.S.C. 804(2).

II. Pertinent Legal Authority

The purpose of the Occupational Safety and Health Act of 1970 (“the OSH Act” or “the Act”), 29 U.S.C. 651 et seq., is to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources. 29 U.S.C. 651(b). To achieve this goal, Congress authorized the Secretary of Labor to promulgate occupational safety and health standards pursuant to notice and comment rulemaking. See 29 U.S.C. 655(b). An occupational safety or health standard is a standard which requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment. 29 U.S.C. 652(8).

The Act also authorizes the Secretary to “modify” or “revoke” any occupational safety or health standard, 29 U.S.C. 655(b), and under the Administrative Procedure Act, 5 U.S.C. 551 et seq., regulatory agencies generally may revise their rules if the changes are supported by a reasoned analysis, see *Motor Vehicle Mfrs. Ass’n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 42 (1983). “While the removal of a regulation may not entail the monetary expenditures and other costs of enacting a new standard, and accordingly, it may be easier for an agency to justify a deregulatory action, the direction in which an agency chooses to move does not alter the standard of judicial review established by law.” *Id.* at 43.

The Act provides that in promulgating health standards dealing with toxic materials or harmful physical agents, such as the beryllium standards, the Secretary must set the standard which most adequately assures, to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has regular exposure to the hazard dealt with

by such standard for the period of his working life. 29 U.S.C. 665(b)(5). The Supreme Court has held that before the Secretary can promulgate any permanent health or safety standard, he must make a threshold finding that significant risk is present and that such risk can be eliminated or lessened by a change in practices. See *Indus. Union Dept., AFL-CIO v. Am. Petroleum Inst.*, 448 U.S. 607, 641-42 (1980) (plurality opinion) (“Benzene”). OSHA need not make additional findings on risk for this proposal because OSHA previously determined that the beryllium standards address a significant risk, see 82 FR 2545-52, and reaffirmed that finding in the rule finalizing the 2017 shipyards and construction proposal, the final rule published September 30, 2019. See *Pub. Citizen Health Research Grp. v. Tyson*, 796 F.2d 1479, 1502 n.16 (D.C. Cir. 1986) (rejecting the argument that OSHA must “find that each and every aspect of its standard eliminates a significant risk”).

OSHA standards must also be both technologically and economically feasible. See *United Steelworkers v. Marshall*, 647 F.2d 1189, 1248 (D.C. Cir. 1980) (“Lead I”). The Supreme Court has defined feasibility as “capable of being done.” *Am. Textile Mfrs. Inst. v. Donovan*, 452 U.S. 490, 509-10 (1981) (“Cotton Dust”). The courts have further clarified that a standard is technologically feasible if OSHA proves a reasonable possibility, “within the limits of the best available evidence, . . . that the typical firm will be able to develop and install engineering and work practice controls that can meet the [standard] in most of its operations.” *Lead I*, 647 F.2d at 1272. With respect to economic feasibility, the courts have held that “a standard is feasible if it does not threaten massive dislocation to or imperil the existence of the industry.” *Id.* at 1265 (internal quotation marks and citations omitted).

OSHA exercises significant discretion in carrying out its responsibilities under the Act. Indeed, a number of terms of the statute give OSHA wide discretion to devise means to achieve the Congressionally-mandated goal of ensuring worker safety and health. See *Lead I*, 647 F.2d at 1230. Thus, where OSHA has chosen some measures to address a significant risk over other measures, those challenging the OSHA standard must “identify evidence that their proposals would be feasible and generate more than a de minimis benefit to worker health.” *N. Am. ’s Bldg. Trades Unions v. OSHA*, 878 F.3d 271, 282 (D.C. Cir. 2017).

Although OSHA is required to set standards “on the basis of the best available evidence,” 29 U.S.C. 655(b)(5), its determinations are “conclusive” if supported by “substantial evidence in the record considered as a whole,” 29 U.S.C. 655(f). Similarly, as the Supreme Court noted in *Benzene*, OSHA must look to “a body of reputable scientific thought” in making determinations, but a reviewing court must “give OSHA some leeway where its findings must be made on the frontiers of scientific knowledge.” *Benzene*, 448 U.S. at 656. When there is disputed scientific evidence in the record, OSHA must review the evidence on both sides and “reasonably resolve” the dispute. *Tyson*, 796 F.2d at 1500. The “possibility of drawing two inconsistent conclusions from the evidence does not prevent the agency’s finding from being supported by substantial evidence.” *N. Am. ’s Bldg. Trades Unions*, 878 F.3d at 291 (quoting *Cotton Dust*, 452 U.S. at 523) (alterations omitted). As the D.C. Circuit has noted, where “OSHA has the expertise we lack and it has exercised that expertise by carefully reviewing the scientific data,” a dispute within the scientific community is not occasion for the reviewing court to take sides about which view is correct. *Tyson*, 796 F.2d at 1500.

Finally, because section 6(b)(5) of the Act explicitly requires OSHA to set health standards that eliminate risk “to the extent feasible,” OSHA uses feasibility analysis rather than cost-benefit analysis to make standards-setting decisions dealing with toxic materials or harmful physical agents (29 U.S.C. 655(b)(5)). An OSHA standard in this area must be technologically and economically feasible—and also cost effective, which means that the protective measures it requires are the least costly of the available alternatives that achieve the same level of protection—but OSHA cannot choose an alternative that provides a lower level of protection for workers’ health simply because it is less costly. See *Int’l Union, UAW v. OSHA*, 37 F.3d 665, 668 (D.C. Cir. 1994); see also *Cotton Dust*, 452 U.S. at 514 n.32. In *Cotton Dust*, the Court explained that Congress itself defined the basic relationship between costs and benefits, by placing the “benefit” of worker health above all other considerations save those making attainment of this “benefit” unachievable. The court further stated that any standard based on a balancing of costs and benefits by the Secretary that strikes a different balance than that struck by Congress would be inconsistent with the command set forth in section 6(b)(5). *Cotton Dust*, 452 U.S. at 509. Thus, while OSHA estimates the costs and benefits of its proposed and final rules, partly in accordance with Executive Orders 12866 and 13771, these calculations do not form the basis for the agency’s regulatory decisions.

III. Summary and Explanation of the Final Rule

The following discussion summarizes and explains the changes OSHA proposed to the beryllium standards for construction and shipyards, discusses the comments received on the proposal, and explains OSHA’s determination with respect to each proposed change.

The 2017 final rule promulgated three standards designed to protect workers from the serious health effects caused by occupational exposure to beryllium and beryllium compounds (see 82 FR 2470 (Jan. 9, 2017)). Each of the three standards, which cover general industry (29 CFR 1910.1024), construction (29 CFR 1926.1124), and shipyards (29 CFR 1915.1024), contains a comprehensive set of protections, consisting of the exposure limits in paragraph (c) and a number of ancillary provisions, typical of OSHA health standards, in paragraphs (d) through (n) (see 82 FR at 2476). The ancillary provisions encompass requirements for exposure assessment, competent person (construction) or regulated areas (shipyards), methods of compliance, respiratory protection, personal protective clothing and equipment, hygiene, housekeeping, medical surveillance and medical removal, communication of hazards, and recordkeeping (29 CFR 1915.1024(d)-(n); 29 CFR 1926.1124(d)-(n)).

Since the publication of the 2017 final rule, OSHA has sought to revise the beryllium standards in a number of separate rulemakings. Those bearing on this proposal include (1) the June 27, 2017, construction and shipyards proposal (82 FR at 29182); (2) the May 7, 2018, general industry direct final rule (DFR) (83 FR at 19936); (3) the December 11, 2018, general industry proposal (83 FR at 63746), (4) the October 8, 2019, construction and shipyards proposal (84 FR at 53902); and (5) the (July 14, 2020) general industry final rule (85 FR 42582) (see Section I, Background, above for more details). In light of the comments OSHA received on these rulemakings and the evidence in the record, OSHA is revising several paragraphs of the beryllium standards for construction and shipyards.

OSHA has determined that, taken together, the limited exposures in the construction and shipyards industries and the partial overlap between the beryllium standards and other OSHA standards make revisions to both the construction and shipyards beryllium standards appropriate. The rationales for these revisions fall into three categories. First, OSHA is removing or modifying some provisions which—although appropriate in the general industry context—may be unnecessary or require revision to appropriately protect employees in the construction and shipyards industries. As will be explained further, operations with beryllium exposure in the construction and shipyards industries are significantly less varied and employees are exposed to materials with significantly lower content beryllium than in the general industry sector. In addition, employees in these industries receive the protections of several other OSHA standards, as the agency explained in the June 27, 2017, construction and shipyards proposal, in the final rule published on September 30, 2019, and in the subsequent construction and shipyards proposal published on October 8, 2019.

Second, OSHA is revising some provisions of the construction and shipyard standards to avoid inconsistencies with the clarifying changes the agency has made in the (July 14, 2020) general industry final rule. OSHA is aligning these standards to the extent possible because the agency believes that, where there is no substantive difference among industries with respect to a particular provision, applying similar requirements across industries aids both compliance and enforcement. Conversely, applying different requirements to identical situations may lead to confusion. While most of the changes in the July 14, 2020, final rule were designed specifically for general industry, OSHA is aligning changes to paragraph (b), medical definitions; paragraph (k), medical

surveillance; and paragraph (n), recordkeeping, because the rationale underlying these changes applies equally in the construction and shipyards contexts.

Third, OSHA is revising certain paragraphs of the construction and shipyard standards to address the application of provisions related to dermal contact to materials containing beryllium in trace quantities. In the general industry DFR, OSHA clarified that provisions triggered by dermal contact with beryllium or beryllium contamination would apply only for dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight (83 FR at 19939). OSHA's rationale regarding this final set of proposed changes dates back to the agency's August 7, 2015, beryllium NPRM (which led to the 2017 final rule) (80 FR at 47565). There, OSHA proposed to exempt materials containing less than 0.1 percent beryllium by weight on the premise that workers exposed only to beryllium as a trace contaminant are not exposed at levels of concern (80 FR at 47775). However, the agency noted evidence of high airborne exposures in construction and shipyard sectors, in particular during blasting operations and cleanup of spent media (80 FR at 47733). Therefore, OSHA proposed for comment several regulatory alternatives, including an alternative that would expand the scope of the proposed standard to include all operations in general industry where beryllium exists only as a trace contaminant (80 FR at 47730) and an alternative that would expand the scope to include employers in the shipyard and maritime sectors (80 FR at 47777).

In the 2017 final rule, after considering stakeholders' comments, OSHA decided to apply the exemption for materials containing less than 0.1 percent beryllium by weight only where the employer has objective data demonstrating that employee exposure to airborne beryllium will remain below the action level of $0.1 \mu\text{g}/\text{m}^3$, measured as an 8-

hour TWA, under any foreseeable conditions (82 FR at 2643). OSHA noted that the action level exception ensured that workers with airborne exposures of concern were covered by the standard. OSHA agreed with the many commenters and public hearing testimony expressing concern that hazardous exposures to beryllium can occur with materials containing trace amounts of beryllium. While the agency acknowledged concerns expressed by the Abrasive Blasting Manufacturing Alliance (ABMA) and the Edison Electric Institute that processing materials with trace amounts of beryllium may not necessarily produce significant exposures to beryllium, evidence in the record showed significant exposures in some operations using materials with trace amounts of beryllium. OSHA explicitly identified abrasive blasting as one such operation. The agency determined that preventing airborne exposures at or above the action level, even to trace amounts of beryllium, reduces the risk of beryllium-related health effects to workers (82 FR at 2643; see also 82 FR at 2552)

While adopting this limited exemption for trace materials, OSHA also adopted the regulatory alternative expanding the scope of the rule to include both construction and shipyards, but recognized that these sectors had limited operations that generated airborne beryllium exposures of concern and issued separate standards for these sectors. Nonetheless, OSHA applied similar ancillary requirements across the general industry, construction, and shipyards beryllium standards. At the same time, the agency acknowledged that different approaches may be warranted for some provisions in construction and shipyards than for general industry due to the nature of the materials and work processes typically used in those industries (82 FR at 2690). Specifically, exposures to beryllium in construction and shipyards are limited to only a few operations, primarily

abrasive blasting in construction and shipyards and some welding operations in shipyards (see Document ID 2042, FEA Chapter III, pp. 103-11 and Table III-8e). While the high airborne exposures during the blasting operation can expose workers to beryllium in excess of the PEL, the blasting materials contain only trace amounts of beryllium (materials such as coal slag normally contain approximately 11 µg/g or 0.0001 percent) (Document ID 2042, Chapter IV, Technological Feasibility, Table IV.69). Furthermore, the rulemaking record contains evidence of beryllium exposure only during limited welding operations in shipyards (only 4 of 127 sample results showed detectable levels of airborne beryllium) (Document ID 2042, Chapter IV, Technological Feasibility, p. IV-580).

As the regulatory history suggests, OSHA intended to protect employees working with trace beryllium when those employees experience significant airborne exposures. OSHA did not intend for provisions aimed at protecting workers from the effects of dermal contact to apply in the case of materials containing only trace amounts of beryllium in the absence of significant airborne beryllium exposure. For this reason, OSHA clarified in the general industry DFR that provisions triggered by dermal contact with beryllium or beryllium contamination would apply only for dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight (83 FR at 19939). In construction and shipyards, where beryllium exposure occurs almost exclusively from materials that contain beryllium in concentrations less than or equal to 0.1 percent by weight, OSHA proposed to remove provisions triggered by dermal contact or beryllium contamination entirely, except for certain provisions the agency deemed important to limit airborne exposure (through re-entrainment of

beryllium-containing dust from PPE or other surfaces) to those workers who have significant airborne exposures (see, e.g., 84 FR at 53913). Additionally, although limited welding operations in shipyards may include base materials or fume containing more than 0.1 percent beryllium by weight, OSHA has reason to believe that skin or surface contamination is not an exposure source of concern in these operations (84 FR at 53906).

Based on the foregoing, OSHA proposed and is now finalizing revisions to the following paragraphs of the beryllium standards for construction and shipyards: paragraph (b), definitions; paragraph (f), methods of compliance; paragraph (g), respiratory protection; paragraph (h), personal protective clothing and equipment; paragraph (i), hygiene areas and practices; paragraph (j), housekeeping; paragraph (k), medical surveillance; paragraph (m), communication of hazards; and paragraph (n), recordkeeping. OSHA is finalizing the standards as proposed, except for minor modifications to the following paragraphs: (1) paragraph (b), specifically, by amending the definition of *CBD diagnostic center* and removing the definition of *high efficiency particulate air (HEPA) filter*; (2) paragraph (f)(1), the written exposure control plan; (3) paragraph (h), personal protective clothing and equipment; and (4) paragraph (k), medical surveillance.

OSHA notes that in response to the October 8, 2019 NPRM, several industry commenters responded that OSHA's proposed changes to simplify and better tailor the construction and shipyards standards would not go far enough, and that none of the beryllium standards' ancillary provisions are necessary (see, e.g., Document ID 2203, p. 1-2, 11; 2199, p. 3; 2205, p. 2; 2206, pp. 10-13; 2209, pp. 1-2; 2241, pp. 3-4). For example, the Abrasive Blasting Manufacturing Alliance (ABMA) claimed that "[t]here is

no evidence that the pre-existing standards governing abrasive blasting are insufficient to protect employees, and there is no evidence that exposure to the trace amounts of naturally occurring beryllium in abrasive blasting (or welding) has resulted in any material impairment of health to employees in all of the many years this work has been performed” (Document ID 2206, p. 11).

Comments suggesting that OSHA entirely eliminate the ancillary provisions of the construction and shipyards standards are beyond the scope of this rulemaking and were already addressed in the September 30, 2019, final rule (84 FR 51377). OSHA did not propose in this rulemaking to remove the standards’ ancillary provisions in their entirety, and in fact, explained in the NPRM that the September 2019 final rule established that removing the ancillary provisions in their entirety would not sufficiently protect workers in these industries from airborne exposure to beryllium (84 FR at 51390-97).

After reviewing the comments and evidence in the record, OSHA determined that beryllium construction and shipyards standards consisting only of the TWA PEL and STEL would not be sufficiently protective (84 FR at 51390-91). Other OSHA standards do contain some requirements that overlap with, or duplicate, the requirements of the beryllium standards for construction and shipyards. In particular, as explained below in the Summary and Explanation for the removal of paragraph (i), OSHA has determined that other OSHA standards overlap with the previous hygiene requirements of the construction and shipyards standards. However, for most ancillary provisions, there is only partial overlap, and for the remainder, there is no overlap at all. Thus, in the September 30, 2019 final rule, OSHA determined not to adopt its proposal to remove all

ancillary provisions from the construction and beryllium standards (84 FR at 51390-91). In that final rule, OSHA also reaffirmed its finding that beryllium exposure presents a significant risk of material health impairment to workers in the construction and shipyards sectors (84 FR at 51388-90). Commenters to the October 8, 2019, proposal have provided no new information indicating that protections are unnecessary in these sectors, and OSHA finds that the ancillary provisions that it is retaining in this final rule are necessary and appropriate to protect workers in the construction and shipyards industries.

The remainder of this summary and explanation provides detail on the changes OSHA is finalizing to the beryllium standards for construction and shipyards, including the agency's review of the evidence in the record and the reasoning for its determinations.

Paragraph (b) Definitions

Paragraph (b) of the beryllium standards for construction and shipyards specifies the definitions of terms used in the beryllium regulatory text. This final rule modifies several definitions of the 2017 standards: *CBD diagnostic center*, *chronic beryllium disease (CBD)*, and *confirmed positive*; adds a definition of *beryllium sensitization*; and eliminates the definitions of *emergency* and *high-efficiency particulate air (HEPA) filter*. The revised definitions include several changes from previous paragraph (b) that OSHA proposed in the October 2019 NPRM, and all of the changes apply to both the construction and shipyards standards. A discussion of each definition affected by OSHA's proposed changes to paragraph (b), comments and testimony received on the proposal, and the final version of each revised definition follows.

OSHA proposed to modify the definitions of *CBD diagnostic center*, *chronic beryllium disease (CBD)*, and *confirmed positive* and add a definition of *beryllium sensitization* to align these definitions in the construction and shipyards standards with changes the agency had already proposed to the beryllium standard for general industry. OSHA proposed these modifications for the general industry standard in December 2018 to clarify the meaning of the terms used in that standard (83 FR at 63747). OSHA provided a sixty-day comment period for the general industry proposal, which closed on February 11, 2019. OSHA's rationale for including these definitions applies equally in the construction and shipyards contexts. Therefore, as discussed in the NPRM, in addition to the comments received during this rulemaking OSHA has considered the comments that were submitted in response to the proposed changes to definitions in the general industry standard along with comments received during this rulemaking on the proposed definitions in determining whether to finalize the proposed definitions in the construction and shipyards standards. The comments to the general industry proposal can be found in Docket OSHA-2018-0003 at <http://regulations.gov>. In addition, OSHA proposed to remove references to the term *emergency* throughout the construction and shipyards standards, including the definition in paragraph (b).

Beryllium Sensitization

This final rule defines the term *beryllium sensitization* as a response in the immune system of a specific individual who has been exposed to beryllium. The definition also states that there are no associated physical or clinical symptoms and no illnesses or disability with beryllium sensitization alone, but the response that occurs through beryllium sensitization can enable the immune system to recognize and react to

beryllium. It further states that while not every beryllium-sensitized person will develop CBD, beryllium sensitization is essential for development of CBD. The agency is adding this definition to clarify other provisions in the standard, such as the definitions of *chronic beryllium disease (CBD)* and *confirmed positive*, as well as the provisions for medical surveillance in paragraph (k) and hazard communication in paragraph (m).

As also explained in the 2020 beryllium final rule for general industry (85 FR 42582), this definition of *beryllium sensitization* is identical to the definition proposed in the 2018 NPRM for general industry and the 2019 NPRM for construction and shipyards, and is consistent with information provided in the 2017 final beryllium rule (82 FR at 2470). In the preamble to the 2017 final rule, OSHA found that individuals sensitized through either the dermal or inhalation exposure pathways respond to beryllium through the formation of a beryllium-protein complex, which then binds to T-cells stimulating a beryllium-specific immune response (82 FR at 2494). The formation of the T-cell-beryllium-protein complex that results in beryllium sensitization rarely manifests in any outward symptoms (such as coughing or wheezing); most who are sensitized show no symptoms at all (see 82 FR at 2492, 2527). Once an individual has been sensitized, any subsequent beryllium exposures via inhalation can progress to serious lung disease through the formation of granulomas and fibrosis (see 82 FR at 2491-98). Since the pathogenesis of CBD involves a beryllium-specific, cell-mediated immune response, CBD cannot occur in the absence of sensitization (82 FR at 2492; Document ID 1355). Therefore, this definition's explanation that beryllium sensitization is essential for development of CBD is consistent with the agency's findings in the 2017 final rule (82 FR at 2470).

Several commenters expressed support for the proposed inclusion of a definition of *beryllium sensitization* in OSHA’s beryllium standards, including National Jewish Health (NJH) (Document ID 2211, p. 3; 2243 p. 1; OSHA-2018-0003-0022, p. 2), the United Steelworkers (USW) (Document ID 2222, Tr. 24-25; 2242, p. 2; OSHA-2018-0003-0033, p. 1), and Materion Brush (Materion) (Document ID 2237, p. 4; OSHA-2018-0003-0038, p. 8). For example, USW stated that the proposed definition of sensitization is clear and accurate, and is necessary because the beryllium standard includes many provisions related to the recognition of and appropriate response to beryllium sensitization among beryllium-exposed workers (Document ID OSHA-2018-0003-0033, p. 1). The agency also received supportive comments in response to the beryllium general industry NPRM, which proposed an identical definition of beryllium sensitization, from the U.S. Department of Defense (DOD) (OSHA-2018-0003-0029, p. 1), and Edison Electric Institute (Document ID OSHA-2018-0003-0031, p. 2).

Some commenters expressed concerns regarding OSHA’s proposed definition of *beryllium sensitization*.³ First, NJH stated that OSHA’s definition is “at odds with” the definition of sensitization included in the guidelines of the American Thoracic Society (ATS), which, in 2014, published a Statement on Beryllium (ATS Statement) that included the following definition: “Beryllium sensitization is a response in the immune system of an individual who has been exposed to beryllium. A diagnosis of [beryllium sensitization] can be based on two abnormal blood BeLPTs, one abnormal and one

³ Comments from the U.S. House of Representatives Committee on Education and Labor (CEL) stated that decoupling the term *beryllium sensitization* from OSHA’s definition of *confirmed positive* (discussed later in this Summary and Explanation) would have consequences for workers who leave employment already sensitized to beryllium because their medical records would only state “confirmed positive,” rather than “beryllium sensitized” (Document ID 2208, pp. 4-5). OSHA addresses CEL’s comments in the Summary and Explanation of the definition of *confirmed positive*.

borderline blood BeLPT, three borderline BeLPTs, or one abnormal bronchoalveolar lavage (BAL) BeLPT. Beryllium sensitization is essential for development of CBD” (Document ID 2243, p. 2; OSHA-2018-0003-0027 p. 1; OSHA-2018-0003-0022, p. 2; OSHA-2018-0003-0364, pp. 1, 44).⁴ The American College of Occupational and Environmental Medicine (ACOEM) similarly stated that the definition of beryllium sensitization “has always been two abnormal, one abnormal and one borderline, or three borderline LPT results,” which it characterized as consistent with the research literature and with how the term “beryllium sensitization” is used in clinical practice and medical surveillance. In contrast, it said, OSHA’s less precise proposed definition for beryllium sensitization could—together with its use of the term “confirmed positive” (see discussion below)—create confusion in clinical practice (Document ID 2213, p. 2). In response to OSHA’s general industry NPRM, the National Supplemental Screening Program (NSSP) and NJH also recommended that OSHA’s definition of *beryllium sensitization* should include text based on the ATS Statement on Beryllium (Document IDs OSHA-2018-0003-0027, p. 1; OSHA-2018-0003-0022, p. 2).

NJH proposed that OSHA should modify its definition of *beryllium sensitization* to the following: “Beryllium sensitization is the result of a beryllium specific cell-

⁴ NJH also stated that in order for a medical condition to be covered under Worker’s Compensation, it needs to meet the statutory language requirements. NJH expressed concern that the statement that there is “no illness or disability with beryllium sensitization alone” in OSHA’s proposed definition could preclude workers with beryllium sensitization from obtaining Workers’ Compensation coverage and medical follow up in some states, including clinical evaluation for CBD once they leave employment (Document ID 2243, pp. 2-3). At the hearing, NJH further explained that, in light of how diagnoses of pleural plaque have affected the individuals’ ability to obtain benefits for lung cancer or mesothelioma, OSHA’s definition could adversely affect workers’ ability to obtain benefits for CBD in the future by prematurely triggering the statute of limitations for such claims. (Document ID 2222, Tr. 39-41).

OSHA intends for the definition of confirmed positive to serve only as a trigger for certain provisions of the beryllium standard. How OSHA defines this phrase for purposes of the beryllium standard in no way limits healthcare professionals’ ability or incentive to diagnose beryllium sensitization.

mediated immune response of an individual who has been exposed to beryllium. A diagnosis of beryllium sensitization can be based on two abnormal blood BeLPTs, one abnormal and one borderline blood BeLPT, or one abnormal bronchoalveolar lavage (BAL) BeLPT. Three borderline BeLPTs may also indicate sensitization” (Document ID 2211, p. 3; 2243, p.2). NJH believes that its proposed definition would be more consistent with ATS’ definition and would not preclude follow-up examinations of sensitized workers for CBD under workers’ compensation coverage.

Materion disagreed with NJH’s argument, stating that OSHA’s definition of *beryllium sensitization* and its complementary definition of *confirmed positive* (discussed later) “align well with the ATS definitions,” and also stated that the definitions in the beryllium standards “should exist to best serve the understanding of employers and employees, not the medical community” (Document ID 2237, p. 3).

OSHA has considered the comments submitted by NJH, ACOEM, Materion, and NISSP, and has concluded that the proposed definition of *beryllium sensitization*, when properly read in the context of the standards and in combination with the definition of *confirmed positive*, does not contradict the definitions used by ATS or other organizations, and is not likely to create confusion in clinical practice. The agency is providing a definition of *beryllium sensitization* to give stakeholders, such as employers and employees, a general understanding of what beryllium sensitization is and its relationship to CBD.

The definition of *confirmed positive* explains how the results of BeLPT testing should be interpreted in the context of the standard’s provisions that benefit beryllium-exposed workers, specifically, medical surveillance and medical removal protection. The

confirmed positive definition establishes that these benefits should be extended to workers who have a pattern of BeLPT results, obtained in a three-year period, consistent with the NJH's recommended definition of *beryllium sensitization*.

In their comments on the general industry standard, NISSP objected to the statement in the definition that no physical or clinical symptoms, illness, or disability are associated with beryllium sensitization alone, but did not explain the reason for their concern (Document ID OSHA-2018-0003-0027, p. 1). Materion supported the agency's inclusion of this information in the definition, stating that "employees deserve to understand that beryllium sensitization does not involve symptoms..." (Document ID OSHA-2018-0003-0038, p. 5). USW also specifically supported the accuracy of this section of OSHA's proposed definition of beryllium sensitization (Document ID OSHA-2018-0003-0033, p. 1).

As explained in the Summary and Explanation for paragraph (b) of the July 14, 2020, final rule revising the general industry standard (85 FR 42582), OSHA decided to retain the statement that there is no illness or disability with beryllium sensitization in the definition of *beryllium sensitization* because it is important that employers and employees understand the asymptomatic nature of beryllium sensitization and the need for specialized testing such as the BeLPT. The statement is consistent with OSHA's discussion of beryllium sensitization in the 2017 final rule (82 FR at 2492-99). As OSHA discussed in the 2017 final rule, sensitization through dermal contact has sometimes been associated with skin granulomas, contact dermatitis, and skin irritation, but these reactions are rare and those sensitized through dermal exposure to beryllium typically do not exhibit any outward signs or symptoms (see 82 FR 2488, 2491-92, 2527). OSHA

determined that while beryllium sensitization rarely leads to any outward signs or symptoms, beryllium sensitization is an adverse health effect because it is a change to the immune system that leads to risk of developing CBD (82 FR at 2498-99). The agency believes that the asymptomatic nature of beryllium sensitization, especially in the lung, should be conveyed to employers and employees to emphasize why specialized testing such as the BeLPT should be provided to workers who may have no symptoms of illness associated with beryllium exposure. For these reasons, OSHA is retaining the statement “[t]here are no associated physical or clinical symptoms and no illness or disability with beryllium sensitization alone” in the definition of *beryllium sensitization*.

As discussed in greater detail in the beryllium final rule for general industry (85 FR 42582), the State of Washington Department of Labor and Industries, Division of Occupational Safety and Health (DOSH), commented that OSHA’s proposed definition of beryllium sensitization places unnecessary emphasis on the role that beryllium sensitization plays in the development of CBD. According to DOSH, “[t]his language may cause confusion with proper diagnosis of CBD and application of the rule requirements for workers who have developed CBD without a confirmed beryllium sensitization” (Document ID OSHA-2018-0003-0023, p. 1). However, other commenters, including NJH, NSSP, and USW, supported including the statement that beryllium sensitization is necessary for the development of CBD in OSHA’s definition of beryllium sensitization (Document ID OSHA-2018-0003-0022, p. 2; OSHA-2018-0003-0027, p. 1; OSHA-2018-0003-0033, p. 1).

Following consideration of DOSH’s comment, OSHA has determined that this information should remain in the definition of *beryllium sensitization* (as well as the

definition of *chronic beryllium disease*, discussed later). OSHA believes that an understanding of the relationship between beryllium sensitization and CBD is essential to workers' and employers' understanding of the beryllium standard. By including the role that sensitization plays in the development of CBD in the definition of beryllium sensitization, OSHA intends to make a number of things clear to workers and employers: that beryllium sensitization, although not itself a disease, is nevertheless an adverse health effect that presents a risk for developing CBD and thus should be prevented; the need to identify beryllium sensitization through regular medical screening; and why workers who are confirmed positive should be offered specialized medical evaluation and medical removal protection. OSHA notes that DOSH does not dispute the factual accuracy of OSHA's statement regarding the role beryllium sensitization plays in the development of CBD, which the agency established in the Health Effects section of the 2017 final standard (82 FR at 2495-96).

OSHA believes that emphasizing the role that beryllium sensitization plays in the development of CBD provides employers and employees with important context for understanding the beryllium standard. At the same time, the agency acknowledges that employees may be diagnosed with CBD in the absence of a confirmed positive BeLPT, and the beryllium standard allows for such a diagnosis. In the preamble to the general industry final rule, OSHA provides additional discussion of the provisions that allow for referral to a CBD diagnostic center and diagnosis with CBD in the absence of a confirmed positive blood BeLPT result (85 FR 42598).

Thus, following consideration of the record of comments on OSHA's proposed definition of *beryllium sensitization* (which includes the comments and response detailed

in the beryllium general industry final rule, 85 FR 42596), OSHA is finalizing the definition as proposed in the 2019 NPRM. The addition of this definition for beryllium sensitization does not change employer obligations under paragraphs (k) and (m) and therefore maintains employee protections under the construction and shipyards standards for beryllium.

CBD Diagnostic Center

This final rule defines a *CBD diagnostic center* to mean a medical diagnostic center that has a pulmonologist or pulmonary specialist on staff and on-site facilities to perform a clinical evaluation for the presence of CBD. The revised definition also states that a CBD diagnostic center must have the capacity to perform pulmonary function testing (as outlined by the American Thoracic Society), bronchoalveolar lavage (BAL), and transbronchial biopsy. In the revised definition, a CBD diagnostic center must have the capacity to transfer the BAL samples to a laboratory for appropriate diagnostic testing within 24 hours and the pulmonologist or pulmonary specialist must be able to interpret the biopsy pathology and the BAL diagnostic test results. This definition is identical to the definition of *CBD diagnostic center* that OSHA proposed in the 2019 NPRM.

The revised definition of *CBD diagnostic center* differs from the former definition in a number of ways. First, whereas the 2017 final rule's definition specified only that a CBD diagnostic center must have a pulmonary specialist, OSHA is adding the term "pulmonologist" to clarify that either type of specialist is qualified to perform a clinical evaluation for the presence of CBD. Additionally, the 2017 definition required that a CBD diagnostic center have an on-site pulmonary specialist. The revised definition states that the CBD diagnostic center must simply have a pulmonologist or pulmonary specialist

on staff. This clarifies OSHA's intent that a pulmonary specialist must be available to the CBD diagnostic center, but need not necessarily be on site at all times.

In their comments on the proposed changes to the definition of *CBD diagnostic center*, NJH and ATS recommended that a pulmonologist, occupational medicine specialist, or physician with expertise in beryllium disease conduct the clinical evaluation for CBD, and that a pulmonologist should be on staff or available to perform the bronchoscopy (Document ID 2211, pp. 3-4; OSHA-2018-0003-0022, p. 2; OSHA-2018-0003-0021, p. 2). According to NJH, clinics that regularly evaluate patients for CBD have physicians with experience in occupational medicine conduct the clinical evaluation for CBD, in conjunction with a pulmonologist who performs a bronchoscopy (Document ID 2211, pp. 3-4; OSHA-2018-0003-0022, pp. 2-3).

OSHA notes that, although the agency is requiring facilities to have a pulmonologist or pulmonary specialist on staff who is able to interpret the biopsy pathology and the BAL diagnostic test results, OSHA does not intend that all aspects of clinical evaluation for CBD must be performed by a pulmonologist or pulmonary specialist. In the preamble to the 2017 final rule, OSHA explained that the agency was defining a *CBD diagnostic center* as a facility with a pulmonary specialist "on-site" specifically to indicate that the specialist need not personally perform the BeLPT testing (82 FR at 2645). Moreover, paragraph (k)(7), which sets out the substantive requirements for the evaluation at the CBD diagnostic center, refers to recommendations of the "examining physician," not necessarily the pulmonologist or pulmonary specialist.

Paragraph (b), in turn, defines *physician or other licensed health care professional (PLHCP)* as an individual licensed to provide some or all of the services

required by paragraph (k). As such, some parts of the evaluation, such as lung function tests, might be performed by a certified medical professional other than a pulmonologist or pulmonary specialist. The arrangement that NJH describes as typical for clinics treating CBD patients, in that physicians with experience in occupational health conduct the clinical evaluation for CBD in conjunction with a pulmonologist who performs a bronchoscopy, is consistent with OSHA's intent for the definition of *CBD diagnostic center* and other provisions of the standard related to CBD diagnosis. Therefore, OSHA has determined that it is not necessary to revise the definition of *CBD diagnostic center* to require that the clinical evaluation for CBD be conducted by a pulmonologist, occupational medicine specialist, or physician with expertise in beryllium disease.

An additional change to the definition of *CBD diagnostic center* clarifies that the diagnostic center must have the capacity to perform pulmonary function testing (according to ATS criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. OSHA has determined that the former definition—which stated that the evaluation at the diagnostic center “must include” these tests—could have been misinterpreted to mean that the examining physician was required to perform each of these tests during every clinical evaluation at a CBD diagnostic center. The agency is not dictating which tests an evaluation at a CBD diagnostic center should include, but ensuring that CBD diagnostic centers have the capacity to perform these tests, which are commonly needed to diagnose CBD. Therefore, the agency is revising the definition to clarify that the CBD diagnostic center must simply have the ability to perform each of these tests when deemed appropriate. These changes clarify the definition of *CBD diagnostic center*, and OSHA expects they will maintain safety and health protections for workers.

NJH expressed concern that the proposed definition does not specify the tests to be performed at the CBD diagnostic center, but only that the CBD diagnostic center have the capacity to conduct the tests (Document ID 2222, Tr. 70-72). NJH commented that by specifying the required capacities of a CBD diagnostic center, rather than the contents of a CBD evaluation, OSHA's change to the definition may indicate that the clinical evaluation for CBD need not include certain aspects of a CBD evaluation. NJH, the Association of Occupational and Environmental Clinics (AOEC), and ATS recommended that, at minimum, examinations should include full pulmonary function testing (including lung volumes, spirometry and diffusion capacity for carbon monoxide), chest imaging, and cardiopulmonary exercise testing, and may also include bronchoscopy in some cases (Document ID 2211, p. 4; OSHA-2018-0003-0022, p. 3; OSHA-2018-0003-0028, p. 2; OSHA-2018-0003-0021, pp. 1-2). NJH recommended that OSHA require ATS recommendations for diagnostic evaluation, which the NJH stated include the BeLPT, pulmonary function testing and chest imaging; and in some cases bronchoscopy (Document ID 2211, p. 4; OSHA-2018-0003 0022, p. 3). In their comments on the general industry NPRM, Materion supported OSHA's intent to specify the required capacities of a CBD diagnostic center, rather than the contents of a CBD evaluation, in the definition of CBD diagnostic center (Document ID OSHA-2018-0003-0038, pp. 16-17).

OSHA believes that the concerns expressed by NJH are already covered by the standard, as discussed more thoroughly in the Summary and Explanation for paragraph (k), Medical Surveillance, in this final rule. First, paragraph (k)(3) sets the requirements for contents of an examination. For the initial and periodic medical examinations, OSHA

already requires under (k)(3) that employees be offered: a physical exam with emphasis on the respiratory system and skin rashes; pulmonary function tests, performed in accordance with established guidelines by ATS, including forced vital capacity (FVC) and forced expiratory volume in one second (FEV₁); a BeLPT or equivalent test; a low dose computed tomography (LDCT) scan, if recommended by the PLHCP; and any other test deemed appropriate by the PLHCP. OSHA believes this information should be available to the CBD diagnostic center upon request.

Second, paragraph (k)(7)—which establishes the substantive requirements for the evaluation at the CBD diagnostic center—also provides the examining physician at the CBD diagnostic center flexibility to determine which additional tests are appropriate. As explained below in the Summary and Explanation of paragraph (k)(7), OSHA is adding a provision (paragraph (k)(7)(ii)) to make clear that the employer must offer any tests that the examining physician at the CBD diagnostic center deems appropriate. The definition of *CBD diagnostic center* in paragraph (b) does not alter this requirement. In light of paragraph (k), the revised definition of CBD diagnostic center cannot reasonably be read to limit the types of tests available to the employee (see the summary and explanation for paragraph (k)(7) for a full discussion of this topic). Thus, after considering these comments, OSHA has decided to retain the proposed change to the definition of *CBD diagnostic center*.

Chronic Beryllium Disease (CBD)

OSHA is also amending the definition of *chronic beryllium disease (CBD)*. For the purposes of this standard, the agency is using the term *chronic beryllium disease* or

CBD to mean a chronic granulomatous lung disease caused by inhalation of beryllium by an individual who is beryllium sensitized.

OSHA is finalizing the definition as proposed. It includes several changes to the 2017 final rule's definition of *chronic beryllium disease*, which was "a chronic lung disease associated with exposure to airborne beryllium" (82 FR at 2645-46). The revisions serve to differentiate CBD from other respiratory diseases associated with beryllium exposure (e.g., lung cancer) and to make clear that beryllium sensitization and the presence of beryllium in the lung are essential in the development of CBD (see 82 FR at 2492).

First, OSHA is adding the term "granulomatous" to the definition.

"Granulomatous" is meant to indicate an infiltration of inflammatory cells (e.g., T-cells) leading to the focal collection of cells, and eventual creation of nodules in the lung (Ohshimo et al., 2017, Document ID 2171, p. 2; Williams and Williams, Document ID 2228, pp. 727-30; ATS, Document ID 0364). The formation of the type of lung granuloma specific to a beryllium immune response can only occur in those with CBD (82 FR at 2492-502). Next, OSHA is removing the phrase "associated with airborne exposure to beryllium" and replacing it with "caused by inhalation of airborne beryllium." This change is more consistent with the findings in the 2017 final rule that beryllium is the causative agent for CBD and that CBD only occurs after inhalation of beryllium (82 FR at 2513). Finally, OSHA is clarifying that CBD is caused by inhalation of airborne beryllium "by an individual who is beryllium sensitized." Along with the revised definition of beryllium sensitization discussed above, this revision emphasizes to

employers and employees the role that beryllium sensitization plays in the development of CBD.

NJH, USW, and Materion agreed that OSHA's definition of CBD should be clarified (Document ID 2211, p. 4; 2222, Tr. 50-51; Document ID OSHA-2018-0003-0038, p. 17; Document ID OSHA-2018-0003-0033, p. 5). Materion supported the changes that OSHA proposed, which it characterized as a necessary clarification to ensure the definition provided is specific to chronic beryllium disease (Document ID 2237, pp. 4-5; OSHA-2018-0003-0038, p. 17). USW similarly supported the proposed definition, stating that it clarifies the previous definition which "could be read to apply to any chronic lung disease caused by beryllium, including lung cancer" (Document ID OSHA-2018-00003-0033, p. 5). These comments reinforce OSHA's determination that adding the term "granulomatous" to the definition will better distinguish CBD from other occupationally associated chronic pulmonary diseases. As OSHA explained in the preamble to the 2017 final rule, the formation of the type of lung granuloma specific to a beryllium immune response can only occur in those with CBD (82 FR at 2492-502).

Several commenters expressed concern that the proposed definition of *chronic beryllium disease* does not provide sufficient information to guide the diagnosis of CBD, or that aspects of OSHA's proposed definition of CBD could complicate the diagnosis of CBD. Comments expressing such concern from NJH, ACOEM, ATS, DOSH, and NSSP are discussed in detail below. OSHA notes that the standard's definition of *chronic beryllium disease* is not intended to provide criteria for the diagnosis of CBD. The agency's intent is to provide readers who may have little or no familiarity with CBD with a general understanding of the term, not to provide diagnostic criteria for healthcare

professionals. This is evident from the broadly written 2017 final rule definition of chronic beryllium disease: “a chronic lung disease associated with exposure to airborne beryllium” (82 FR at 2645-46).

Due to differences in individual cases and circumstances, medical specialists may need to apply somewhat different testing regimens and/or diagnostic criteria to different individuals they evaluate for CBD. Furthermore, the diagnostic tools and criteria available to medical specialists may change over time. As discussed in the summary and explanation for paragraph (k)(7), OSHA believes that the physician at the CBD diagnostic center should have the latitude to use any tests he or she deems appropriate for the purpose of diagnosing or otherwise evaluating CBD in a patient, and has revised paragraph (k)(7) to make this clear. Therefore, OSHA has determined that it is neither necessary nor appropriate to specify diagnostic criteria in the beryllium standard’s definition of *chronic beryllium disease*. Instead, OSHA has decided to retain a definition that provides the reader with a general understanding of the term.

NJH and ATS commented that OSHA should adopt a definition of *chronic beryllium disease* based on the previously-mentioned 2014 ATS document on diagnosis and management of beryllium sensitization and CBD (Document ID 2211, p. 4; 2222, Tr. 50; OSHA-2018-0003-0021, p. 5). NJH suggested the following definition: “Chronic beryllium disease (CBD) is a granulomatous inflammatory response in the lungs of an individual who is beryllium sensitized” (Document ID 2211, p. 4).⁵ In the beryllium

⁵ In their comments on the general industry NPRM, NJH previously suggested that the agency define *chronic beryllium disease* as a disease “characterized by evidence of granulomatous lung inflammation in an individual who is sensitized to beryllium.” According to NJH, this definition would allow for diagnosis based on different combinations of clinical evaluation results as detailed in the ATS Statement (Document ID OSHA-2018-0003-0022, p. 3). OSHA’s response to NJH’s new suggested definition also pertains to this previously suggested definition.

informal hearing, they appeared to object to the term “granulomatous inflammation” and to prefer the term “granuloma inflammatory process” (Document ID 2222, Tr. 50). NJH stated that OSHA should adopt a definition based on the ATS beryllium statement “that says, ‘Chronic beryllium disease is a granuloma inflammatory process,’ and note that this is different than granulomatous inflammation or granulomas... chronic beryllium disease is a granulomatous inflammatory process in the lungs of an individual who is beryllium sensitized” (Document ID 2222, Tr. 50). NJH further stated that their proposed definition “allows for some flexibility” in diagnosing CBD (Document ID 2222, Tr. 50). OSHA notes that the ATS statement primarily discusses CBD as a granulomatous inflammatory response in the lungs (Document ID 0364).

As discussed above, OSHA has determined that it is neither necessary nor appropriate to provide diagnostic criteria in the beryllium standard’s definition of *chronic beryllium disease*. Instead, OSHA has decided to retain a definition that provides the reader with a general understanding of the term. OSHA believes that the definition the agency proposed—a chronic granulomatous lung disease caused by inhalation of airborne beryllium by an individual who is beryllium-sensitized—adequately conveys that CBD is granulomatous in nature, and that it is not necessary for the agency’s purposes to further specify that it is an inflammatory process. OSHA has therefore decided not to adopt the definition that NJH suggested.

ACOEM objected to the inclusion of the term “granulomatous” in the definition of *chronic beryllium disease* (Document ID 2213, p. 3). ACOEM contended that CBD does not always include the presence of granulomas and the lung pathology is more consistent with “mononuclear cell interstitial infiltrates.” According to ACOEM, it is

established in the medical literature that the lung pathology found in CBD does not always include granulomas; lung biopsies may not detect granulomas, either due to practical limitations of the test or because the patient's stage of disease is too early (i.e., the cells of the immune system that form granulomas have accumulated in the lungs, but have not yet formed into clusters) (Document ID 2213, p.3). ACOEM expressed concern that, if OSHA's [a]ddition of the term "granulomatous" to the definition excludes cases where granulomas are not present, it "may result in some workers being unnecessarily excluded from appropriate medical care under the OSHA rule, and may affect their ability to receive workers' compensation, due to the overly narrow definition" (Document ID 2213 p. 3). ACOEM further noted that the presence of beryllium sensitization "lends specificity to the diagnosis"; therefore, it is not necessary to use the term "granulomatous" for the sake of specificity in the definition.

OSHA disagrees with ACOEM's contention that including the term "granulomatous" in the agency's definition of *chronic beryllium disease* would be inaccurate or overly narrow, and could thereby prevent workers from obtaining appropriate medical care or benefits for CBD. To begin with, OSHA's definitions in paragraph (b) of the standard are intended only to clarify the meaning of terms that appear in the standard. The definition of *chronic beryllium disease* is written with the goal of providing readers of the standard, who may have little or no familiarity with CBD, with a general understanding of the term. The definition does not provide diagnostic criteria for healthcare professionals to follow when diagnosing and addressing CBD.

Moreover, ACOEM's concerns are unfounded because including the term "granulomatous" does not exclude cases of CBD where granulomas have not yet formed or are not detected by lung pathology. OSHA agrees with ACOEM that CBD includes mononuclear cell infiltrates and can be diagnosed in the absence of lung pathology findings of granulomas in the lung. As described in the Health Effects section of the 2017 final rule, CBD is a pathological continuum which results from lung exposure to beryllium. The continuum consists of an asymptomatic early response with the recruitment of inflammatory T-cells and other mononuclear cells through to the formation of granulomas and frank, chronic disease (82 FR at 2491-2502). However, the term "granulomatous" does not refer only to the presence of granulomas; the term "granulomatous" inflammation is described in the literature as beginning with chronic inflammation predominated by mononuclear phagocyte cells leading to the eventual aggregation of these cells into focal lesions called granulomas (ATS, Document ID 0364; Ohshimo et al., 2017, Document ID 2171, p. 2; Williams and Williams, 1983, Document ID 2198). OSHA finds that adding the term "granulomatous" to the definition of CBD, contrary to the concerns raised by ACOEM, does not imply that CBD cannot be diagnosed where granulomas have not yet formed or are not detected by lung pathology.

ACOEM also noted that "the presence of beryllium sensitization (as measured in BeLPT using either blood or lung cells) lends specificity to the diagnosis," which makes including the term "granulomatous" unnecessary (Document ID 2213, p. 3). OSHA disagrees. First, including the term "granulomatous" is consistent with the ATS statement "the diagnosis of CBD is based on the demonstration of both BeS and granulomatous inflammation on lung biopsy." (Document ID 0364, p. e35, e43-e45, e55). Based on the

ATS statement, NJH also recommended a definition of chronic beryllium disease that included a reference to “granulomatous inflammation” (Document ID 2211, p. 4).

Second, as noted in the summary and explanation section for the 2020 general industry beryllium final rule (85 FR 42598), OSHA acknowledges that it may not always be possible to identify a worker for beryllium sensitization using the BeLPT as part of a diagnosis of CBD because the BeLPT can yield false-negative results in some individuals (see Document ID 0399). This means some individuals may actually be sensitized to beryllium even though they have a negative BeLPT result; therefore, there is value to adding the term “granulomatous” to lend further specificity. An examining physician should have the latitude to diagnose CBD even in the absence of a “confirmed positive” pattern of BeLPT results 85 FR 42598), for example, in the presence of lung inflammation. The latitude and flexibility provided under these standards affords physicians the discretion to diagnose CBD in patients that may not have the classic hallmarks of sensitization or CBD (e.g. positive BeLPT or granuloma), but have a work history of exposure to beryllium and an undiagnosed health issue. However, OSHA emphasizes that the definition of *chronic beryllium disease* is to inform the general reader of this preamble and final rule, and is not intended to guide physician diagnosis of CBD.

In their comments on the 2018 general industry NPRM, ATS recommended including diagnostic criteria in the definition, such as confirmation of an immune response to beryllium and granulomatous lung inflammation using lung biopsy, and that the definition emphasize the various approaches which may be used “[d]epending on the clinical setting, feasibility of certain diagnostic tests, and degree of diagnostic certainty needed” (Document ID OSHA-2018-0003-0021, p. 5). ATS also expressed concern that

OSHA's proposed changes to the definition of *chronic beryllium disease* could create confusion in the diagnosis of CBD because, "[w]hile beryllium sensitization is essential to the development of CBD, demonstrating beryllium sensitization, as well as granulomatous lung disease on lung pathology, can be challenging in certain settings" (Document ID 0021, p. 5). DOSH stated that the proposed definition "emphasizes beryllium sensitization as a factor in chronic beryllium disease in a manner that may be misleading" and emphasized that individuals may be diagnosed with CBD without a confirmed positive BeLPT result. DOSH advocated that the definition of *chronic beryllium disease* "ensure employers and medical providers are given a clear expectation of how beryllium conditions are properly identified" (Document ID OSHA-2018-0003-0023, p. 2).

Although OSHA agrees with ATS and DOSH that diagnosing CBD does not always require confirmation of beryllium sensitization, the agency does not believe that references to sensitization should be excluded from the definition of *chronic beryllium disease*. OSHA first notes that neither DOSH nor ATS contend that OSHA's definition is inaccurate. Furthermore, as OSHA explained previously in its discussion of the *beryllium sensitization* definition, the agency believes that a correct understanding of the relationship between beryllium sensitization and CBD is key to workers' and employers' understanding of many provisions of the beryllium standard. By stating the role that sensitization plays in the development of CBD in the standard's definition of *chronic beryllium disease*, OSHA intends to convey clearly to the regulated community why protecting workers from becoming beryllium-sensitized is key to the prevention of CBD

and why workers who are confirmed positive for beryllium sensitization should be offered both a clinical evaluation for CBD and medical removal protection.

OSHA acknowledges that it is not always necessary to identify a worker as confirmed positive for beryllium sensitization using the BeLPT as part of a diagnosis of CBD and that the BeLPT can yield false-negative results in some individuals. For this reason, an examining physician should have the latitude to diagnose CBD even in the absence of a “confirmed positive” pattern of BeLPT results. As explained in the summary and explanation of paragraph (k)(7) of the beryllium final rule (2017), that provision gives the examining physician this latitude (82 FR at 2704, 2709). Because the substantive provisions of the standard leave the examining physician discretion in diagnosing CBD, OSHA does not agree that acknowledging the role of beryllium sensitization in the development of CBD will result in diagnostic confusion. As stated above, the agency does not intend for the definition to be used for diagnostic criteria, but rather to add clarity to the standard and provide readers who may have little or no familiarity with CBD with a general understanding of the term.

NSSP recommended the following addition to OSHA’s proposed definition of *chronic beryllium disease*: “The presence of interstitial mononuclear cell (T cell) infiltrates (lymphocytosis) is characteristic of chronic beryllium disease” (Document ID 0027, pp. 3-4). NSSP argued that the presence of these infiltrates on lung biopsy indicates the presence of chronic beryllium disease, and should therefore be included in the standard’s definition (Document ID 0027, p. 4). OSHA disagrees. The agency believes that the term “granulomatous” sufficiently addresses the presence of T-cell infiltrates, which occur at an early stage in the development of granulomas (82 FR at 2492-2502).

As discussed previously, OSHA's intent in defining *chronic beryllium disease* is to provide the reader a general understanding of what CBD is, rather than provide a technical definition for diagnostic use. The suggested addition is not necessary to describe the nature of CBD in general terms. With the addition of the term "granulomatous," the definition is sufficiently specific for OSHA's purposes in the context of paragraph (b).

In summary, for the purposes of this standard OSHA is defining *chronic beryllium disease* as a chronic granulomatous lung disease caused by inhalation of airborne beryllium by an individual who is beryllium sensitized. This definition is identical to the definition of *chronic beryllium disease* OSHA proposed in 2019 and includes only minor changes from the definition included in the 2017 final standard. OSHA is providing this definition to enhance stakeholders' general understanding of the beryllium standard; it is neither intended nor suitable to provide guidance to medical professionals on the diagnosis of CBD. OSHA expects these changes to the 2017 definition of *chronic beryllium disease* will clarify the standard, and will therefore maintain safety and health protections for workers. After considering these comments and after reviewing the record as a whole (which includes the comments and responses detailed in the July 14, 2020, general industry final rule (82 FR 42602)), OSHA has decided to amend the definition of *chronic beryllium disease (CBD)* as proposed.

Confirmed Positive

This final rule defines *confirmed positive* to mean (1) the person tested has had two abnormal BeLPT test results, an abnormal and a borderline test result, or three borderline test results, obtained within a three-year period; or (2) the result of a more

reliable and accurate test indicating a person has been identified as having beryllium sensitization. The revised definition includes several changes to the 2017 definition of *confirmed positive* and one change from the definition of *confirmed positive* that OSHA proposed in the 2019 NPRM.

First, the agency is removing the phrase “beryllium sensitization” from the first sentence of the definition, which previously stated that a person is confirmed positive if that person has beryllium sensitization, as indicated by two abnormal BeLPT test results, an abnormal and a borderline test result, or three borderline test results. OSHA intends that the term *confirmed positive* act only as a trigger for requirements in the standards, such as continued medical monitoring and surveillance for the purposes of these standards, and not as a general-purpose definition of *beryllium sensitization*. By removing the phrase “beryllium sensitization” from the first sentence of the definition, the agency hopes to avoid confusion resulting from scientific disagreements over whether certain test results, such as three borderlines, necessarily prove that sensitization has occurred. For purposes of the beryllium standards, any worker with the BeLPT test results specified in the definition of *confirmed positive* should be offered an evaluation for CBD with continued medical surveillance as well as the option of medical removal protection, even though some small percentage of workers who are confirmed positive by this definition may not in fact be sensitized to beryllium, as is the case for any diagnostic test (Middleton, et. al., 2008, Document ID 0480, p. 4).⁶

⁶ In the preamble to the 2017 final rule, OSHA found that three borderline BeLPT results recognize a change in a person’s immune system with respect to beryllium exposure based on Middleton et al.’s 2011 finding that three borderline BeLPT results have a positive predictive value (PPV) of over 90 percent (82 FR at 2501), and therefore the agency included three borderline results in the criteria for confirmed positive (82 FR at 2646). While Materion contests the findings of the Middleton et al study (2011) regarding three borderline BeLPTs, Materion was generally supportive of removing sensitization from the definition,

Both USW and Materion supported this proposed revision. USW supported removing the phrase beryllium sensitization because, “[w]hile it is true that a confirmed positive result of BeLPT testing currently leads to a diagnosis of sensitization, linking the two in the same definition could lead to unintended hardships for beryllium workers” (Document ID 2242, p. 3). At the December 3, 2019 public hearing, USW also explained that a finding of beryllium sensitization could, in some states, trigger a statute of limitations under laws governing claims for compensation for other adverse health effects (Document ID 2222, Tr. 24-25). According to USW, “the word ‘sensitized’ is more likely to trigger a statute-of-repose deadline for filing a tort suit than the words ‘confirmed positive,’” and should that happen, “the worker would not be able to receive adequate compensation if they later developed chronic beryllium disease” (Document ID 2242, p. 3). Materion commented that “OSHA’s separation of beryllium sensitization from confirmed positive can increase the number of employees eligible to accept further medical testing by institutions such as NJH or to seek OSHA’s medical removal option,” as well as the number of employees “who may choose to be medically monitored on a more routine basis at institutions such as NJH” (Document ID 2237, p. 4).

In its comments on the general industry NPRM, USW also commented that the former definition of *confirmed positive* had acted “as a de facto definition of sensitization” and that removing the phrase “beryllium sensitization” from this portion of the definition ensures that a finding of confirmed positive will trigger medical surveillance and medical removal protection, “without an intermediate stop at a finding of sensitization” (Document ID OSHA-2018-0003-0033, p. 5). Similarly, Materion

stating that the agency “wisely splits[s] the definition of beryllium sensitization, which is a medical determinant, from confirmed positive, which is a testing regimen outcome” (Document ID 2237, pp. 3-4).

commented in their response to the general industry NPRM that the revised definition allows individuals with three borderline BeLPT results to obtain the protections of the standard, including evaluation for CBD and medical removal protection, without necessarily being “declared sensitized” (Document ID OSHA-2018-0003-0038, p. 18). Materion further asserted that the change enhances employee protection by increasing the number of persons eligible to go on to further testing (Document ID OSHA-2018-0003-0038, p. 19).

Several commenters disagreed with OSHA’s proposal to remove the phrase “beryllium sensitization” from the definition of *confirmed positive*. Nssp generally expressed disagreement with OSHA’s proposal to remove “beryllium sensitization” from the first part of the *confirmed positive* definition, but did not state the reasons for its concern (Document ID OSHA-2018-0003-0027, p. 3).

Several commenters expressed concern that OSHA’s proposed revision would create confusion. NJH stated that removal of “beryllium sensitization” would cause confusion as to what the term “confirmed positive” refers, and stated that workers need to understand that, if they are confirmed positive, they have a specific T-cell mediated response to beryllium that can result in development of CBD (Document ID 2222, Tr. 64; 2211, p. 5). ACOEM commented that “[s]eparating the definition of ‘confirmed positive’ from the definition of beryllium sensitization is confusing, unnecessary, and contradicts the accepted terminology and definitions employed in the fields of immunology, beryllium medical research, and clinical practice ...” ACOEM further stated that, “[i]n clinical practice, [the change] will add significant confusion, to the detriment of workers and patients,” because “[t]he medical community is not accustomed to diagnosing a

patient's medical condition as 'confirmed positive,'” and instead refers to patients as being “beryllium sensitized” based on “the presence of confirmed positive BeLPTs.”⁷ (Document ID 2213, p. 2).

ATS and AOEC also expressed concern that, because the medically-accepted interpretation of BeLPT testing results is that they indicate beryllium sensitization, removing the phrase “beryllium sensitization” from the definition of *confirmed positive* may cause confusion about the condition to which *confirmed positive* refers (Document ID OSHA-2018-0003-0021, p. 3; OSHA-2018-0003-0028, p. 2). CEL cited to, and expressed support for, ATS' and AOEC's comments regarding this change, and also expressed concern that, after a worker leaves employment, their medical record might only state that they were “confirmed positive,” rather than “beryllium sensitized,” which could create confusion for medical personnel who may later evaluate or treat the worker (Document ID 2208, p. 5).

Commenters also expressed concern that removing “beryllium sensitization” from the definition could negatively affect workers' ability to obtain workplace protections and other benefits. NJH stated that removing “beryllium sensitized” from the definition of *confirmed positive*, in conjunction with OSHA's proposal to place a time constraint on confirmation testing results in the definition (discussed below), might reduce workers' ability to obtain medical testing and workplace protections that are required by the rule

⁷ ACOEM also stated that the proposed change would create confusion by creating “misalignment with existing legislation, including the Energy Employee Occupational Illness Compensation Program Act (1999) and the U.S. Department of Energy's beryllium rule (Document ID 2213, p. 2). To the extent that ACOEM suggests that OSHA is obliged to adopt definitions that match those used in other statutes of federal regulations for the same or similar terms, ACOEM is mistaken. OSHA has discretion to adopt appropriate definitions for the terms in its beryllium standards, including the definition of confirmed positive, which serves as a trigger for certain provisions of the beryllium standards. As explained further below, OSHA does not agree that the definition of *confirmed positive* that it is adopting in this rule will result in confusion.

(Document ID 2243, p. 3). NJH also opposed the revised definition in their comments on the 2018 general industry NPRM, asserting that the removal of the phrase “beryllium sensitized” could prevent individuals who meet the definition of being confirmed positive from being identified as sensitized (Document ID OSHA-2018-0003-0022, p. 4). ATS also stated (without explanation) that removing the term “beryllium sensitization” from the definition of *confirmed positive* would reduce worker protections (Document ID OSHA-2018-0003-0021, p. 3)

Additionally, NJH, ATS, and CEL expressed concern that removing “beryllium sensitization” from the definition of *confirmed positive* would adversely affect workers’ ability to obtain workers compensation benefits. NJH commented that the proposed change, in conjunction with OSHA’s proposal to place a time constraint on confirmation testing results (discussed below), would prevent individuals from being diagnosed with beryllium sensitization, which is medically compensable under workers’ compensation programs in many states (Document ID 2243, p. 3). CEL cited to ATS’s stated concern that removing the phrase “beryllium sensitization” would reduce workers’ right to file for worker’s compensation (Document ID 2208, p. 5 (citing 0021, p. 3)).

Commenters also expressed concern that the proposed revision of the *confirmed positive* definition was inconsistent with other parts of the standard. CEL and ACOEM claimed that the change would create an inconsistency with the definition of *Chronic Beryllium Disease (CBD)*, which defines CBD as “a chronic granulomatous lung disease caused by inhalation of airborne beryllium by an individual *who is beryllium-sensitized*” (emphasis added) (Document ID 2208, p. 5; 2213, p. 2). CEL also expressed concern that “the definition of beryllium sensitized no longer refers to the definition of ‘confirmed

positive,’ which defines the criteria for being determined beryllium sensitized.”

Additionally, CEL noted that, paragraph (k)(5)(i)(A) of the rule, which articulates the necessary contents of the written medical report given to the employee under the standard’s medical surveillance requirements, “equates ‘beryllium sensitization’ with an employee’s status as ‘confirmed positive’ which is consistent with the original 2017 standards, but not consistent with the decoupling of these terms in the current proposal” (Document ID 2208, p. 5).

Following consideration of the concerns raised by these organizations, OSHA disagrees that removing the phrase “beryllium sensitization” from the first sentence of the definition of *confirmed positive* will create confusion, reduce worker protections, or conflict with other aspects of the regulatory text. The provisions of the standards intended to benefit workers who may be sensitized (specifically, evaluation at a CBD diagnostic center and medical removal protection) are available to all workers who meet the definition of *confirmed positive*. Therefore, removing the term “beryllium sensitized” from the first sentence of the definition will not change the access to these benefits for any workers. By removing the term “beryllium sensitized” from the first sentence of the definition, OSHA seeks to ensure that workers with three borderline BeLPT results (or other patterns of test results that some PLHCPs may consider ambiguous) will receive the benefits of the standard regardless of whether their PLHCP views their results as firm evidence of sensitization.⁸ Furthermore, OSHA disagrees that removing the reference to

⁸ OSHA is also unpersuaded by the comments expressing concern that OSHA’s revision of the definition of *confirmed positive* in the beryllium standards would affect workers’ ability to obtain workers compensation benefits. ATS’s comment did not explain how the definition of confirmed positive in the beryllium standard could affect worker’s compensation claims, but at least one other commenter questioned the ATS’s assertion (see Document ID 0038, p. 19). NJH expressed concern that the change would prevent individuals from being diagnosed with beryllium sensitization, which would trigger their eligibility for benefits under some states’ workers compensation programs (Document ID 2243, p. 3). OSHA intends for

“beryllium sensitized” will lead to confusion about what the BeLPT results are supposed to indicate because the second sentence of the definition of *confirmed positive* makes clear that a worker who has been diagnosed with beryllium sensitization would also meet the definition of *confirmed positive*: “It [i.e., confirmed positive] also means the result of a more reliable and accurate test indicating a person has been identified as having beryllium sensitization.”

OSHA also disagrees with the commenters’ concern that the proposed definition will create inconsistencies within the standard. CEL’s concern that removing the term “beryllium sensitized” from the first sentence of *confirmed positive* will create an inconsistency with paragraph (k)(5)(i)(A) because that provision “equates ‘beryllium sensitization’ with an employee’s status as ‘confirmed positive’ is misplaced. Paragraph (k)(5)(i)(A), which is not being changed in this final rule, requires that the licensed physician’s written medical report for the employee include any detected medical condition, such as CBD or beryllium sensitization (i.e., the employee is confirmed positive, as defined in paragraph (b) of the standard), that may place the employee at increased risk from further airborne exposure. As explained above, the purpose of the agency’s definition of *confirmed positive* is to establish the test results that trigger the benefits in the standards aimed at protecting potentially beryllium-sensitized individuals (specifically, an evaluation for CBD with continued medical surveillance, and the option of medical removal protection). The phrasing of the *confirmed positive* definition does not affect the relevant detectable medical conditions that physicians are instructed to

the definition of confirmed positive in paragraph (b) to serve only as a trigger for certain provisions of the beryllium standards. How OSHA defines this phrase for purposes of the beryllium standards in no way limits healthcare professionals’ ability or incentive to diagnose beryllium sensitization.

include in their written reports under paragraph (k)(5)(i)(A). The reference to *confirmed positive* in paragraph (k)(5)(i)(A) is intended to signal that, where a physician has identified a worker as having beryllium sensitization, that individual also satisfies the definition of *confirmed positive*.

Nor does removing the reference to “beryllium sensitized” from the definition of *confirmed positive* create an inconsistency with the standards’ definitions of *chronic beryllium disease* or *beryllium sensitization*. As discussed above, the definition of *confirmed positive* explains the test results that, in the context of these beryllium standards, triggers the benefits intended to protect individuals who may be beryllium-sensitized. Such results include both employees who are identified as having beryllium sensitization, and employees who have three borderline BeLPT results (or other patterns of test results that some PLHCPs may consider ambiguous) but may not be affirmatively identified by the physician as beryllium-sensitized. The definitions of *beryllium sensitization* and *chronic beryllium disease (CBD)* are informational definitions that do not trigger any specific protections in the standards, and are solely included to help readers generally understand those terms. The definition of *chronic beryllium disease (CBD)* clarifies that individuals that have CBD have beryllium sensitization, and the definition of *beryllium sensitization* explains that “[w]hile not every beryllium-sensitized person will develop CBD, beryllium sensitization is essential for development of CBD.” OSHA finds no conflict between these definitions and the definition of *confirmed positive*.

An additional change to the definition of *confirmed positive* provides that the findings of two abnormal, one abnormal and one borderline, or three borderline results

need to occur from BeLPTs conducted within a three-year period. This change in the definition of *confirmed positive* differs from the proposal and is based on comments submitted to the record following publication of the 2018 NPRM for general industry and the 2019 NPRM for construction and shipyards.

The 2017 final rule did not specify a time limit within which the BeLPT tests that contribute toward a finding of “confirmed positive” must occur. After publication of the 2017 final rule, stakeholders suggested to OSHA that the definition of *confirmed positive* could be interpreted as meaning that findings of two abnormal, one abnormal and one borderline, or three borderline results over any time period, even as long as 10 years, would result in the employee being confirmed positive and automatically referred to a CBD diagnostic center for evaluation. As discussed in the preamble to the 2017 standard, clinical evaluation for CBD involves bronchoalveolar lavage and biopsy (82 FR at 2497) which, like all invasive medical procedures, carry risks of infection and other complications.⁹ Given such risks, and the possibility that some repeat abnormal or borderline results obtained over a long period of time could be false positives, it was not the agency’s intent that workers with rarely recurring abnormal or borderline BeLPT results should necessarily proceed to evaluation at a CBD diagnostic center unless recommended to do so by their examining physician. At the same time, OSHA notes that under paragraph (k)(5)(iii), the licensed physician performing the BeLPT testing retains the discretion to refer an employee to a CBD diagnostic center if the licensed physician deems it appropriate, regardless of the BeLPT result.

⁹ Bronchoalveolar lavage is a method of “washing” the lungs with fluid inserted via a flexible fiberoptic instrument known as a bronchoscope, removing the fluid and analyzing the content for the inclusion of immune cells reactive to beryllium exposure (82 FR at 2497).

In the 2019 NPRM, OSHA proposed that any combination of test results specified in the definition of *confirmed positive* must result from the tests conducted in one cycle of testing, including the initial BeLPT and the follow-up retesting offered within 30 days of an abnormal or borderline result (paragraph (k)(3)(ii)(E)). As outlined in proposed paragraph (k)(3)(ii)(E), an employee would be offered a follow-up BeLPT within 30 days if the initial test result is anything other than normal, unless the employee had been confirmed positive (e.g., if the initial BeLPT was performed on a split sample and showed two abnormal results). Thus, for example, if an employee's initial test result was abnormal, and the result of the follow-up testing offered to confirm the initial test result was abnormal or borderline, the employee would be confirmed positive. Alternatively, if the result of the follow-up testing offered to confirm the initial abnormal test result was normal, the employee would not be confirmed positive. Any additional abnormal or borderline results obtained from the next required BeLPT for that employee (typically, two years later) would not identify that employee as confirmed positive under the proposed modification to *confirmed positive*. OSHA requested comments on the appropriateness of this proposed time period.

Several stakeholders, including Materion, NJH, ACOEM, AFL-CIO, CEL, and USW, submitted comments regarding OSHA's proposal to require that the test results specified in the agency's definition of confirmed positive must occur within a single testing cycle. OSHA also received comments from Materion, NJH, ATS, DOSH, NSSP, USW, and AOEC on this proposed revision in the 2018 NPRM for general industry.

Commenters focused on several aspects of the proposed timing. First, many of the comments focused on the logistics of OSHA's proposed change. NJH, ACOEM, AFL-

CIO, USW, ATS, DOSH, AOEC, and NSSP all indicated that requiring results with a 30-day testing cycle could create logistical challenges, for example due to repeat testing requirements or for businesses in remote areas with access to limited healthcare facilities (Document ID 2211, pp. 5-7; 2213, pp. 2-3; 2244, pp. 17-18; OSHA-2018-0003-0033, p. 5; OSHA-2018-0003-0022, p. 4; OSHA-2018-0003-0021, p. 4; OSHA-2018-0003-0024, p. 1; OSHA-2018-0003-0027, p. 3). Materion agreed with these commenters that “the 30 day initial testing period may not allow enough time to complete retesting of workers due to issues beyond the control of the employer or employee” (Document ID 2237, p. 5).¹⁰

In this final rule and preamble, OSHA clarifies that it did not intend that the initial and follow-up tests had to be completed and interpreted within 30 days. OSHA intended that the test results used to determine if a worker is confirmed positive be obtained during one cycle of testing (i.e., an initial or periodic examination), including follow-up testing conducted within 30 days of an abnormal or borderline result.

Secondly, stakeholders commented on the appropriateness of limiting the use of the BeLPT from one test cycle in determining if a worker is confirmed positive. Commenters from public health organizations raised concerns that limiting test results to one test cycle would affect the ability to identify workers who should be referred for a CBD evaluation and receive other protections under the standard. NJH stated that OSHA’s proposal to place a time constraint on confirmation testing results would reduce workers’ ability to obtain medical testing and workplace protections that are required by

¹⁰ In their comments on the 2018 general industry NPRM, Materion supported the proposed definition of *confirmed positive*, stating that a 30-day allowance for follow-up testing after a first abnormal or borderline BeLPT result is appropriate to ensure that testing is completed in a timely manner (Document ID OSHA-2018-0003-0038, p. 17).

the rule.¹¹ NJH proposed the following definition be used: “Confirmed positive means the person tested has beryllium sensitization as demonstrated by two abnormal BeLPT test results, an abnormal and a borderline test result, three borderline test results or the result of a more reliable and accurate test for sensitization” (Document ID 2243, p. 3).

Other public health organizations, including ACOEM, DOSH, ATS, NSSP, AOEC, and CEL, agreed with NJH that workers who are sensitized to beryllium may show varying test results over time, and restricting the time period for determining “confirmed positive” status to 30 days would cause sensitized individuals to go undetected (Document ID 2213, pp. 2-3; 2208, pp. 3-4; OSHA-2018-0003-0023, p. 2; OSHA-2018-0003-0021, p. 2; OSHA-2018-0003-0027, p. 3; OSHA-2018-0003-0028, p. 2). ACOEM commented that the 30-day cycle would exclude workers who might have confirmatory tests several years after the initial first positive result, and stated that there is potential for confirmatory results could take up to 10 years to occur. ACOEM also stated that “[t]here is no justification or need for a restrictive time limit for the occurrence of confirmatory tests,” but if OSHA determined that a time limit was needed as a practical matter, ACOEM stated that at least three years should be permitted for repeat testing to identify confirmed positive results (Document ID 2213, p. 2).

ATS and AOEC recommended that results from tests performed up to at least three years after the initial abnormal or borderline test result should be used to determine whether the person is confirmed positive for beryllium sensitization (Document ID

¹¹ As discussed above, NJH expressed concern that OSHA’s proposed definition of confirmed positive could prevent individuals from being diagnosed with beryllium sensitization, and thereby prevent them from receiving workers’ compensation benefits (Document ID 2243, p. 3). OSHA intends the definition of confirmed positive to serve only as a trigger for certain provisions of the beryllium standards. How OSHA defines this phrase for purposes of the beryllium standards in no way limits healthcare professionals’ ability or incentive to diagnose beryllium sensitization.

OSHA-2018-0003-0021, p. 2; OSHA-2018-0003-0028, p. 2). ATS stated that a timeframe of at least three years, which encompasses two rounds of regularly scheduled testing required biennially by the beryllium standard, would adequately address its concerns regarding logistical feasibility, would improve diagnostic accuracy, and would help ensure that sensitized workers are identified (Document ID OSHA-2018-0003-0021, p. 4). The ATS Statement on beryllium sensitization recommends a three-year testing cycle to confirm beryllium sensitization (Document ID 0364, p. e35). AOEC agreed that consideration of BeLPT test results obtained during a time period of at least three years “will increase the potential that workers are accurately diagnosed with beryllium sensitization [and] will receive the necessary care” (Document ID OSHA-2018-0003-0028 p. 2). NABTU noted that the Department of Energy’s (DOE) Building Trades Screening Program also uses a three year testing cycle to confirm workers positive for sensitization (Document ID 2236, p. 2). CEL also commented that “OSHA should significantly lengthen the period allowed between initial and confirmatory testing and develop a testing protocol that is both practicable and based on science” (Document ID 2208, p. 4).

The approaches recommended by the ATS and the AOEC are similar to the approach used by NJH in providing medical surveillance consultation to workforces that use beryllium. NJH stated that, if an individual’s BeLPT results are abnormal and normal on their initial round of BeLPT testing, they will usually request another BeLPT within a month. If the result of that test is normal, they do not request further testing until the next regularly scheduled BeLPT. If the result of the next regularly scheduled BeLPT comes

back abnormal, they refer the worker for clinical evaluation even though the tests are separated by the two-year testing cycle (Document ID OSHA-2018-0003-0022, p. 5).

NJH submitted new, unpublished evidence to the record supporting the appropriateness of extending the test period to at least three years (Document ID 2243, p. 5). NJH's unpublished data was collected from patients that were ultimately diagnosed with CBD by either NJH or Oak Ridge Associated Universities (ORAU). The data (as reported in Tables 1 and 2 below) shows the timeframe from the initial abnormal BeLPT to the second abnormal BeLPT that is required to trigger a clinical evaluation for CBD (Document ID 2243, p. 5).

Table 1. NJH days to confirmed positive

Number of Days	Number confirmed	Percent confirmed
30	44	23
60	93	48
90	122	63
120	136	70
150	144	74
180	155	80
1 year	169	87
2 years	181	93
3 years	186	96
> 3 years	194	100

Table 2. ORAU days to confirmed positive

Number of Days	Number confirmed	Percent confirmed
30	42	17
60	107	44
90	126	52
120	139	58
150	147	61
180	148	61
1 year	182	76
2 years	201	83
3 years	206	85
> 3 years	241	100

Tables 1 & 2 adapted from Document ID 2243, p. 5

As indicated by the evidence in Tables 1 and 2, many workers who develop CBD have abnormal or borderline results that do not immediately repeat upon retesting. To the contrary, many CBD patients have a series of tests which alternate between normal and abnormal. BeLPT data from Table 1, based on NJH's extensive experience, show that the BeLPT does not yield consistently abnormal results among CBD patients. Of 194 patients diagnosed with CBD at NJH, the length of time between abnormal results ranged from 14 days to 5.8 years, with a 95th percentile of 2.9 years. In this group, 150 patients (or 77 percent) would not have been evaluated for CBD if two abnormal BeLPT results were required to occur within a 30-day testing cycle (Document ID 2243, p. 5; OSHA-2018-0003-0022, p. 5). Similar findings are shown in Table 2 (BeLPT data from ORAU, also submitted by NJH (Document ID 2238, p. 5)). Data from Table 2 indicates that 83 percent (199 patients) of individuals who went on to develop CBD would not have been evaluated for CBD if two abnormal BeLPT results were required to occur within a 30-day testing cycle (Document ID 2243, p. 5).

Although the information NJH submitted to the record is unpublished, their findings are consistent with published studies. Kreiss et al. (1997) reported that nine individuals had initial abnormal BeLPT results followed by two normal tests; six of those individuals were re-tested approximately one year later and four were confirmed positive for beryllium sensitization based on abnormal BeLPT results (Document ID 1360, pp. 610-12). These findings suggest a high rate of false-negative results and are consistent with results reported in a study by Stange et al. (2004). That study found an average false-positive rate of 1.09 percent, and a false-negative rate of 27.7 percent for the BeLPT (Document ID 1402, p. 459).

Stakeholders provided similar comments, in response to OSHA's proposed definition of *confirmed positive* in the 2018 general industry NPRM, which was identical to the revised

definition of *confirmed positive* proposed in the 2019 NPRM for construction and shipyards. For example, NSSP cited ORAU data (the same data submitted by NJH and shown in Table 2) from healthcare providers to demonstrate that a 30-day testing cycle is insufficient to properly identify sensitized workers. NSSP noted that, in over 20 years of conducting BeLPTs in worker populations, ORAU observed approximate median times of 45 days (range of 3 days to 16 years) between first and second abnormal tests, 1.5 years (range of 30 days to 11 years) for the abnormal/borderline test combination and 1 year (range of 30 days to 11 years) for three borderlines (Document ID OSHA-2018-0003-0027, p. 3). Under the proposed 30-day requirement, the NSSP stated that the majority of workers who have been identified as sensitized in the past would not meet the proposed definition of confirmed positive (Document ID OSHA-2018-0003-0027, p. 3).

Following consideration of the comments and of the new evidence submitted to the record following the proposal, OSHA is convinced that some workers who are ultimately found to be sensitized to beryllium or diagnosed with CBD may have alternating abnormal and normal BeLPT results, and that the time period for abnormal or borderline results to repeat can be months or years. OSHA is also convinced that requiring two abnormal, an abnormal and borderline, or three borderline results to occur in one cycle of an initial or periodic exam before an employee can be confirmed positive could result in beryllium sensitization or CBD going undetected in many employees. This is demonstrated by the unpublished data submitted by NJH showing that a substantial percentage of individuals with CBD (77 percent) may not have been referred for further testing based on results obtained within a 30-day cycle of testing and is confirmed by the data from ORAU that NSSP presented in response to the 2018 general industry NPRM (85 FR42605). Therefore, OSHA finds that its proposed change would have the

unintended and unacceptable consequence of reducing employee protections because some employees who are sensitized or have CBD would be deprived of the benefits available through the standard, such as a timely evaluation at a CBD diagnostic center. In addition, requiring that results be obtained in one test cycle is not consistent with the approaches currently applied or supported by the medical community.

For these reasons, OSHA is revising the definition of *confirmed positive* to specify that the findings of two abnormal, one abnormal and one borderline, or three borderline results must be obtained from BeLPTs conducted within a three-year period. OSHA agrees with the ATS and the AOEC that a three-year period will facilitate the identification of sensitized workers enrolled in medical surveillance (see Document ID OSHA-2018-0003-0022, p. 5; OSHA-2018-0003-0028, p. 2; Document ID 0364, p. e35). In addition, this approach is consistent with the practices and recommendations from the public health community, including NJH and DOE, which provides beryllium-related medical surveillance consultation. OSHA believes that allowing a worker to be confirmed positive based on BeLPT results obtained over a three-year time period strikes a reasonable balance that would allow a timely evaluation for CBD, while at the same time, maintaining OSHA's original intent that a confirmed positive finding not be based on results obtained over an indefinite time period.

OSHA emphasizes that this revision does not modify the requirements of paragraph (k)(3)(ii)(E). Under that paragraph, if the results of the BeLPT are other than normal, a follow-up BeLPT must be offered within 30 days of receiving the results, unless the employee has been confirmed positive. Only other than normal BeLPT results must be followed up within 30 days of the same test cycle (i.e., an initial or periodic medical examination).

As an example, an employee who receives a borderline result during one periodic examination conducted in 2020 would be retested within 30 days, and if the follow-up test is normal, testing would stop. That employee would be offered another BeLPT at the next periodic examination conducted in 2022. However, if the result of the 2022 test is borderline, the employee would be retested within 30 days of that test result receipt, and if the follow-up test is borderline, the employee would be confirmed positive because of receiving three borderline tests within three years. A three-year period for the employee to be confirmed positive would ensure sufficient time for such follow-up tests that may need to be conducted over two cycles of medical examinations.

In their comments on the 2018 NPRM for general industry, the U.S. Department of Defense (DOD) recommended changing the term “confirmed positive” to another term such as “confirmed non-negative,” “confirmed finding of concern,” or “pattern of concern.” According to the DOD, the term “confirmed positive” typically “implies an initial positive test that was repeated with another test or another, more sensitive test, which confirms the initial positive test result” (Document ID OSHA-2018-0003-0029, p. 2). As OSHA explained in the general industry final rule Summary and Explanation (85 FR 42606), however, the CBD literature, commonly treats individuals as confirmed positive for sensitization through sequentially conducted BeLPTs (see, for example, the ATS Statement on Diagnosis and Management of Beryllium Sensitivity and Chronic Beryllium Disease, ATS 2014, Document ID 0364, p. e41; see also Document ID 1543, 0603, 0398, 1403, 1449). Additionally, OSHA again emphasizes that terms defined in the beryllium standards are defined only for purposes of the standard and are not intended as diagnostic, scientific, or all-purpose definitions. OSHA believes that its definition of *confirmed positive* clearly indicates what that term means for purposes of the beryllium standards and

therefore disagrees with DOD's concern that the term may cause confusion. Accordingly, OSHA is retaining the term "confirmed positive" in this final standard.

Emergency

Finally, OSHA proposed to remove references to the term *emergency* throughout the construction and shipyards standards, including the definition in paragraph (b). The agency explained that, unlike in general industry, the construction and shipyards industries—where exposure to beryllium is almost exclusively limited to trace quantities from abrasive blasting and welding operations—do not have emergencies in which exposures to beryllium will differ from the normal conditions of work. Specifically, OSHA reasoned that an uncontrolled release of airborne beryllium in these industries (such as a release resulting from a failure of the blasting control equipment, a spill of the abrasive blasting media, or failure of the ventilation system for welding operations) would occur only during the performance of routine tasks already associated with the airborne release of beryllium; that is, during abrasive blasting or welding processes. The agency explained that it anticipates employees working in the immediate vicinity of an uncontrolled release of airborne beryllium in these contexts would already be protected from exposure by the standards' existing requirements for respiratory protection (paragraph (g)), medical surveillance (paragraph (k)), and hazard communication (paragraph (m)) due to their existing exposure to airborne beryllium (84 FR at 53909; see also *id.* at 53912, 53918–20).

Accordingly, OSHA preliminarily determined that no requirements should be triggered for emergencies in construction and shipyards and proposed to remove references to emergencies in provisions related to respiratory protection (paragraph (g)), medical surveillance (paragraph (k)), and hazard communication (paragraph (m)). The agency also preliminarily determined that

without these provisions it would be unnecessary to define the term *emergency* in paragraph (b) (84 FR 53909).

Some commenters objected to the proposed removal of provisions relating to emergencies. Specifically, these commenters took issue with OSHA's determination that an uncontrolled release of beryllium in the construction and shipyards industries would not create exposures that differ from normal operations. For a full discussion of these comments and the agency's response, see the summary and explanation for paragraph (g). In short, the agency is not persuaded that the types of uncontrolled releases that necessitated emergency provisions in the general industry standard are present in the construction and shipyards industries. Accordingly, OSHA is finalizing its proposal to remove all references to "emergency" or "emergencies" throughout the construction and shipyards standards. Because those terms no longer appear in the standards' requirements, OSHA is also finalizing its proposal to remove the definition of the term "emergency" from paragraph (b).

This final rule makes one additional revision to paragraph (b) in both standards. As explained in the Summary and Explanation for paragraph (j), OSHA is removing the reference to HEPA-filtered vacuuming in the housekeeping requirements of revised paragraphs (j)(1) and (2). In the NPRM, OSHA neglected to remove the definition for *high-efficiency particulate air (HEPA) filter* in paragraph (b), despite the fact that there are no longer any provisions in either standard that reference HEPA-filters. OSHA has removed this definition in this final rule. This change has no substantive effect on any requirements in the standards and OSHA considers this a technical correction.

Paragraph (f) Methods of Compliance

Paragraph (f) of the beryllium standards for construction and shipyards requires employers to implement methods for reducing employee exposure to beryllium through a detailed written exposure control plan, engineering and work practice controls, and a prohibition on rotating employees to achieve compliance with the PEL. In the 2017 final rule, OSHA determined that written plans would “be instrumental in ensuring that employers comprehensively and consistently protect their employees” (82 FR at 2668). OSHA also concluded that requiring reliance on engineering and work practice controls, rather than on respirator use, is consistent with good industrial hygiene practice and with OSHA’s traditional approach to health standards (82 FR at 2672).

While extending these provisions to the construction and shipyards industry in the 2017 final rule, OSHA acknowledged that exposures to beryllium in these industries are limited primarily to a few operations, abrasive blasting in construction and shipyards and some welding operations in shipyards (82 FR at 2637-38). With respect to abrasive blasting, while the extremely high exposures to airborne particulate during the blasting operation can expose workers to beryllium in excess of the PEL, the blasting materials contain only trace amounts of beryllium (materials such as coal slag normally contain approximately 0.11 µg/g or 0.00001%) (see 2017 FEA, Document ID 2042, p. IV-632, Table IV.69; 82 FR at 2638). Moreover, OSHA had evidence of beryllium exposure during only limited welding operations in shipyards (only 4 of 127 sample results showed detectable levels of airborne beryllium) (see 2017 FEA, Document ID 2042, p. IV-580). Nonetheless, OSHA applied the same requirements to these industries as to general industry, where the operations with beryllium exposure are significantly more varied and employees are exposed to materials with significantly higher beryllium content.

In the 2019 NPRM, OSHA proposed to revise the requirements in paragraph (f) in light of the very narrow set of affected operations and the limited extent of beryllium exposure in the construction and shipyards industries. OSHA explained that some provisions in paragraph (f)—although appropriate in the general industry context—may be unnecessary to protect employees in the construction and shipyards industries (84 FR at 53909-10). Likewise, OSHA preliminarily determined that provisions relating solely to dermal contact with beryllium should not apply in the construction and shipyards industries, where exposures primarily involve materials containing only trace amounts of beryllium (84 FR at 53909) or, in the case of welding, where OSHA believes the process and materials do not present a dermal contact risk (see 84 FR at 53906). Accordingly, OSHA proposed several revisions to both paragraph (f)(1) (Written exposure control plan) and (2) (Engineering and work practice controls) in the construction and shipyards standards.

For both the construction and shipyards beryllium standards, paragraph (f)(1) in this final rule requires the employer to establish, implement, and maintain a written exposure control plan that includes: a list of operations and job titles reasonably expected to involve exposure to beryllium; a list of engineering controls, work practices, and respiratory protection required by paragraph (f)(2); and a list of personal protective clothing and equipment required by paragraph (h) (see paragraphs (f)(1)(i)(A), (B) and (C), respectively). For the construction standard, the written plan must also include procedures to restrict access to work areas where exposures to beryllium could reasonably be expected to exceed the TWA PEL or STEL (paragraph (f)(1)(i)(D)). Both the construction (paragraph (f)(1)(i)(E)) and shipyards (paragraph (f)(1)(i)(D)) standards require the employer to include procedures to ensure the integrity of each containment used to minimize exposures to employees outside of containments (such as tarps or structures

used to keep sandblasting debris within an enclosed area during abrasive blasting operations). Paragraphs (f)(1)(ii) and (iii) further provide requirements for maintaining, reviewing, and evaluating the written exposure control plan and providing access to the plan to each employee who is, or can reasonably be expected to be, exposed to airborne beryllium. In the construction standard, the written exposure control plan must be implemented by a competent person, as defined by paragraph (b) (paragraph (e)(2)).

Paragraph (f)(1) in this final rule contains several changes from the prior standards, as proposed in the December 2019 NPRM. First, OSHA proposed to revise paragraph (f)(1)(i)(A) by removing the words “airborne” and “or dermal contact with” as qualifiers for exposure to beryllium, so as to require simply a list of operations and job titles reasonably expected to involve exposure to beryllium. Second, OSHA proposed to revoke paragraphs (f)(1)(i)(B) and (C), which required additional lists of operations and job titles involving exposure at or above the action level and above the TWA PEL or STEL, respectively. OSHA reasoned that, given the small number of operations with beryllium exposure in construction and shipyards, the list of operations and job titles in these categories would be the same as those required by paragraph (f)(1)(i)(A). As such, any additional lists would be unnecessary and redundant (84 FR at 53910-11).

OSHA also proposed to revoke the requirements that the employer include in the written exposure control plan procedures for minimizing cross-contamination (paragraph (f)(1)(i)(D)) and procedures for minimizing the migration of beryllium within or to locations outside the workplace (paragraph (f)(1)(i)(E)) (84 FR at 53910). OSHA explained that the original intent of these requirements was to ensure that workers not involved in beryllium-related operations would not be unintentionally exposed to beryllium in excess of the PEL. With respect to the

construction standard, OSHA reasoned that the requirement to include procedures in the written exposure control plan to restrict access to work areas where exposures to beryllium could reasonably be expected to exceed the TWA PEL or STEL (formerly paragraph (f)(i)(E), renumbered as (f)(i)(D)), along with the requirement that these procedures be implemented by a competent person (paragraph (e)(2)), would be sufficient to control cross-contamination and migration of beryllium from abrasive blasting operations. For the shipyard standard, OSHA retained requirements for regulated areas (paragraph (e)), which require that employers designate areas where exposures to beryllium could exceed the PELs and limit access to authorized employees. To further limit cross-contamination and migration, OSHA proposed to add a new paragraph in both the construction ((f)(1)(i)(E)) and shipyards ((f)(1)(i)(D)) standards to require that the written exposure control plan include procedures to ensure the integrity of each containment used to minimize exposures to employees outside the containment (such as tarps or structures used to keep sandblasting debris within an enclosed area during abrasive blasting operations).

OSHA next proposed to remove the requirement that the employer include in the written exposure control plan procedures for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated personal protective clothing and equipment, including respirators (paragraph (f)(1)(i)(H)), because the agency had also proposed to remove several requirements pertaining to such procedures (84 FR at 53911). Specifically, OSHA proposed to remove the requirements that the employer ensure that: beryllium-contaminated PPE is stored and kept separate from street clothes and that storage facilities prevent cross-contamination as specified in the written exposure control plan (paragraph (h)(2)(iii)); beryllium-contaminated PPE is only removed from the workplace by employees who are authorized to do so for the

purpose of laundering, cleaning, maintaining, or disposing of such PPE (paragraph (h)(2)(iv)); PPE removed from the workplace for laundering, cleaning, maintenance, or disposal be placed in closed, impermeable bags or containers and labeled appropriately (paragraph (h)(2)(v)); and any person or business entity who launders, cleans or repairs PPE required by the standards be informed, in writing, of the potentially harmful effects of beryllium and of the need to handle the PPE in accordance with OSHA's beryllium standards (paragraph (h)(3)(iii)). With the proposed removal of those paragraphs, the remaining requirements that would relate to paragraph (f)(1)(i)(H) include paragraphs (h)(2)(i) and (ii), pertaining to removal of PPE; paragraph (h)(3)(i), pertaining to cleaning and maintenance of PPE; and paragraph (h)(3)(ii), pertaining to methods of removing beryllium from PPE. In light of the proposed removal of several of the requirements for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated PPE, OSHA stated that it believed it unnecessary to include such procedures in the written plan (84 FR at 53911).

Finally, as with paragraph (f)(1)(i)(A), OSHA proposed to revise paragraph (f)(1)(ii)(B) to refer simply to "exposure to" rather than "airborne exposure to or dermal contact with" beryllium (84 FR at 53911).¹² OSHA's proposal to revise this paragraph, which previously required the employer to review, evaluate, and update the written exposure control plan, as necessary, when notified that an employee shows signs or symptoms associated with airborne exposure to or dermal contact with beryllium, is consistent with other paragraphs where the

¹² In the Amendments to Standards section of the NPRM (84 FR at 53951-54), which identifies precisely how the proposal would amend the Code of Federal Regulations, OSHA inadvertently failed to remove the word "airborne" as a qualifier for "exposure" in paragraph (f)(1)(ii)(B) of both standards. However, the summary and explanation of paragraph (f) clearly identified OSHA's intent to remove both "airborne" and "dermal contact with" from the provision and leave simply "exposure to beryllium" (see 84 FR at 53911). The only commenter to address the change referred to the correct language (NJH, Document ID 2211, p. 9). Accordingly, OSHA considers this a harmless error and has corrected the appropriate language in the Amendments to Standards section of this final rule.

agency is simplifying the language in a similar manner (e.g., paragraphs (k)(3)(ii)(A) and (k)(4)(i), Medical surveillance) and is not intended to alter the meaning of the provision.

OSHA received a number of comments on its proposed revisions to paragraph (f). These comments and OSHA's final determinations are discussed below.

Comments on the Nature and Extent of Beryllium Exposure in the Construction and Shipyards Industries

A primary issue raised by several commenters, both with respect to the proposed changes to paragraph (f) and to the rest of the proposal, involved whether OSHA has appropriately characterized the jobs and operations in the construction and shipyards industries that present beryllium exposures of concern. On the one hand, the National Electrical Contractors Association (NECA), the National Demolition Association (NDA), and the Construction Industry Safety Coalition (CISC) argued that a written exposure control plan is unnecessary in the construction industry in light of the limited operations that create exposures of concern. Specifically, NECA contended that beryllium exposure in construction is limited to abrasive blasting, and therefore “promulgating a rule that would require all employers to document and implement a written exposure control plan for beryllium creates additional and undue burdens on employers and employees in the construction industry” (Document ID 2209, p. 1). CISC and NDA both stated that, in order to create a written exposure control plan, construction employers “will be required to assess all workplace exposures, jobs, tasks, and work to be performed to determine whether beryllium is present in trace amounts” (Document ID 2203, p. 16; 2205, p. 2). According to CISC, this is a particular problem in the construction industry because of the “range of exposures that could exist as a result of naturally occurring beryllium or airborne exposures of beryllium from aggregate or other components of construction material containing

trace amounts of beryllium” (Document ID 2203, p. 2). Like NECA, CISC argued that it would be inappropriate to require employers to engage in the “daunting task” of analyzing beryllium exposures on their worksites, given that OSHA has not identified exposures of concern in construction outside of abrasive blasting with certain media (Document ID 2203, p. 16). NDA echoed CISC, asserting that this would be an “unnecessary burden” and “inappropriate” in the construction industry (Document ID 2203, p. 2).

CISC suggested that, instead of including a written exposure control plan provision in the beryllium standard for construction, OSHA should consider adding new requirements to paragraph (f) of the ventilation standard for construction (29 CFR 1926.57) that set forth additional protective measures to be used when abrasive blasting with media containing <0.1 percent by weight of beryllium. These new provisions, CISC stated, could include the requirements of written exposure control plans, regulated areas, specified PPE, and other provisions to protect workers in and around such abrasive blasting (Document ID 2203, p. 16).

While industry representatives NECA, NDA, and CISC argued that OSHA’s approach to the written exposure control plan is too broad, other commenters representing unions and public health organizations argued that the proposal is too narrow. Specifically, these commenters took issue with OSHA’s focus on abrasive blasters and welders. Several commenters suggested potential exposure sources apart from abrasive blasting and welding operations and argued that some of these exposures could involve beryllium in greater than trace amounts. For example, NJH contended that there are “other operations, jobs and tasks that can generate beryllium exposure in the construction and shipyard sectors, not limited to abrasive blasting and welding” (Document ID 2211, p. 7). NJH cited studies involving demolition operations at an Army site in Ohio (<https://www.lrb.usace.army.mil/Missions/HTRW/FUSRAP/Luckey-Site>); construction

trades workers exposed to beryllium in DOE facilities (Welch et al., 2004 & 2013); workers performing clean-up of beryllium-using sites (Sackett et al., 2004); workers grinding beryllium-composite tools (Kreiss et al., 1993); and workers resurfacing copper-beryllium tools (Mikulski et al, 2011) (Document ID 2211, p. 7) (see detailed discussion of studies later in this section). NJH also noted, anecdotally, that it has diagnosed CBD in contract construction workers who worked in primary beryllium and beryllium manufacturing facilities (Document ID 2211, p. 7).

AFL-CIO similarly indicated that construction workers such as laborers, welders, carpenters, surveyors, and electricians involved in demolition, renovation, maintenance, repair, and construction projects performed in general industry sites where beryllium was previously used, as well as those who may use non-sparking tools, could be exposed to beryllium (Document ID 2210, p. 5; 2239, p. 1). ACOEM likewise argued that workers in the construction industry can be exposed from decommissioning and demolition work (Document ID 2213, p. 3). Some members of Congress also identified the maintenance of non-sparking tools and working with unspecified beryllium alloys in high-tech naval vessels as activities that expose workers to materials containing beryllium above trace levels (Document ID 2208, p. 6).

Relying largely on studies performed at Department of Energy nuclear weapon sites (some of the same studies cited by NJH), NABTU commented that workers performing maintenance, renovation, repair, and demolition in beryllium processing facilities may be exposed to residual beryllium in ventilation systems, floors, insulation materials, and in floor crevices (Document ID 2202, p. 2; 2240, p. 3). Referencing OSHA's decision in the 2017 final rule to apply the construction standard to all occupational exposures to beryllium, rather than limiting the requirements to abrasive blasting operations, NABTU contended that OSHA's proposal departs from the agency's prior conclusions without explaining this supposed departure.

According to NABTU, OSHA has abandoned its position that the construction standard should “cover all occupational exposures to beryllium” and instead “decided only to address the ‘primary’ means of exposure” (Document ID 2240, pp. 2-5).

In addition to potential exposures from existing operations, USW contended that the proposed revisions to the construction and shipyard standards fail to account for “all future operations” that might use beryllium. By tailoring the standards to the specific exposures in abrasive blasting and welding operations, USW contends that OSHA is making a “dangerous assumption” that it makes “in no other health standard” (Document ID 2212, p. 2). According to USW: “If a new chemical product is synthesized from 1,3-butadiene, the 1,3-butadiene standard will apply in its entirety. If arsenic finds a new use in semiconductors, the employer will be expected to comply with the entire arsenic standard. . . . However, under the OSHA proposal, if metallic beryllium, a beryllium alloy, ceramic or other compound is someday used on a construction site or in a shipyard, exposed workers will lack important protections enjoyed by their counterparts in general industry” (Document ID 2212, p. 2). USW echoed NABTU’s assertion that OSHA’s proposal neglects workers beyond abrasive blasters and welders and concluded that “[o]nly by including all the general industry protections in the shipyard and construction standards can OSHA fulfill [its] mandate” to protect all workers (Document ID 2212, p. 4).

Those commenters who participated in the public hearing also raised these concerns in their testimony. Specifically, both NJH and USW again identified potential exposures from beryllium-containing non-sparking tools (Document ID 2222, Tr. 17-19, 48) and NJH discussed their organization’s past diagnoses of CBD in contract construction workers in the primary beryllium and manufacturing industries (Document ID 2222, Tr. 48). USW again expressed

concern about possible future applications of beryllium-containing materials in construction and shipyard work (Document ID 2222, Tr. 17-19). NABTU and AFL-CIO both reiterated their position that construction workers are exposed through activities other than abrasive blasting, particularly demolition, renovation, cleanup, and similar work in facilities that make and use beryllium-containing alloys (Document ID 2222, Tr. 84, 114-15). NABTU concluded that construction workers operating in facilities that use beryllium “are not only potentially exposed to beryllium, but also, they will have dermal exposure to dust and debris that can contain beryllium at greater than trace amounts” (Document ID 2222, Tr. 84-85).

On the whole, these commenters contend that, because there are work processes other than abrasive blasting and welding that could expose construction and shipyard workers to beryllium, OSHA should not remove or modify provisions of the beryllium standards—such as the written exposure control plan requirements—to tailor the standards to abrasive blasting and welding operations.

After reviewing all of these comments and the record as a whole, OSHA has determined that the record continues to lack sufficient data for the agency to characterize the nature, locations, or extent of beryllium exposure in application groups in current-day construction and shipyards sectors other than abrasive blasting and certain welding operations. Further, although OSHA continues to recognize the possibility of exposures beyond abrasive blasting and welding, the agency has reason to believe concerns regarding construction workers’ dermal exposure to more than trace beryllium at general industry sites, although potentially justified in the past, likely do not reflect current exposures in these contexts.

As a result, OSHA finds that it is appropriate to follow through with its proposal to tailor certain provisions of the beryllium standards for construction and shipyards—including the

written exposure control plan requirements—to those operations for which the agency has data.

At the same time, OSHA disagrees with NECA, NDA, and CISC that the agency should strictly limit application of the beryllium standards to abrasive blasting and welding operations.

Accordingly, both standards will continue to cover all occupational exposures to beryllium in these industries that meet the requirements of paragraph (a). OSHA's reasoning and the agency's response to each of the comments received on these topics is explained below.

OSHA's Analysis of the Record with Respect to Beryllium Exposures in the Construction and Shipyards Sectors

In the 2017 final rule, OSHA based its assessment of applications involving beryllium exposure, including its determination that abrasive blasting and welding are the only known sources of beryllium exposure in construction and shipyards, on the best evidence available in the record. This included a comprehensive review of the industrial hygiene literature; National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluations and case studies of beryllium exposure; site visits conducted by an OSHA contractor (Eastern Research Group (ERG)); inspection data from OSHA's Integrated Management Information System (IMIS) and OSHA's Information System (OIS); and information submitted to the rulemaking docket in response to the notice of proposed rulemaking and informal public hearings, such as a comprehensive data set submitted by the Navy of beryllium sampling in a wide variety of operations (see 82 FR at 2583; 2017 FEA, Document ID 2042, pp. IV-17 to IV-22; Document ID 0144, 0145).

This review also included comments and testimony on potential exposure from sources other than abrasive blasting and welding (82 FR 2636–40). At the time, several commenters identified many of the same jobs and operations as those identified in this rulemaking. NIOSH

commented that construction workers may be exposed to beryllium when demolishing buildings or building equipment, based on a study of workers demolishing oil-fired boilers (Document ID 1671, Attachment 1, pp. 5, 15; 1671, Attachment 21). At the initial public hearing in 2016, NJH testified that numerous studies had documented beryllium exposure, sensitization, and CBD in construction workers performing demolition and decommissioning and among workers who use non-sparking tools (Document ID 1756, Tr. 98). USW also testified that workers in the maritime industry use and may sharpen or grind beryllium-containing non-sparking tools and that shipyards might use beryllium for other tasks in the future. USW further stated that beryllium is a high-tech material and that exposure from beryllium containing alloys cannot be ruled out in high-tech operations such as aircraft carrier or submarine production (Document ID 1756, Tr. 270).

After reviewing the record, OSHA determined in the 2017 final rule that it did not have sufficient data on beryllium exposures in the construction and shipyard industries to characterize exposures in application groups other than abrasive blasting with beryllium-containing slags and certain welding operations in shipyards, and that it could not develop exposure profiles for construction and shipyard workers engaged in activities involving non-sparking tools, demolition of beryllium-contaminated buildings or equipment, or work with beryllium-containing alloys (82 FR at 2639). Even so, OSHA acknowledged USW's concerns about future beryllium use and found "that there is potential for exposure to beryllium in construction and shipyards operations other than abrasive blasting." OSHA concluded that workers engaged in any such operations are exposed to the same hazard of developing CBD and other beryllium related disease (82 FR at 2639). Thus, OSHA chose to cover all occupational exposures to beryllium in those industries in

order to ensure that the standards are broadly effective and address all potentially harmful beryllium exposures (82 FR at 2639).

While extending comprehensive beryllium standards to construction and shipyards and broadly aligning the ancillary provisions across the three sectors, OSHA also identified evidence in the record demonstrating meaningful distinctions between the sectors, and therefore promulgated different requirements for some ancillary provisions. For example, OSHA included requirements pertaining to beryllium work areas (BWAs)¹³ in the standard for general industry but did not include such requirements in the standards for construction and shipyards. OSHA explained that commenters such as Newport News Shipbuilding (NNS) (Document ID 1657) and NIOSH (Document ID 1725, p. 30; 1755, Tr. 21) had brought to its attention difficulties in establishing and maintaining BWAs in an operation such as abrasive blasting (82 FR at 2660-61). NNS specifically highlighted the difficulty of such a requirement where beryllium is encountered in trace concentrations (82 FR at 2661; Document ID 1657, pp. 1-2).

Recognizing that the known exposures in construction and shipyards are to trace beryllium, and further recognizing the difficulties involved in establishing and maintaining BWA requirements in that context, OSHA decided not to require employers in construction and shipyards to establish and maintain BWAs (82 FR 2660-61). In this way, OSHA differentiated the construction and shipyards standards from the general industry standard and tailored portions of the former to the particular exposures in abrasive blasting operations. OSHA thereby made the

¹³ As originally promulgated, the beryllium standard for general industry required employers to establish a beryllium work area in any area that (1) contains a process or operation that can release beryllium, and (2) where employees are, or can reasonably be expected to be, exposed to airborne beryllium at any level or where there is the potential for dermal contact with beryllium (82 FR at 2736). BWAs must be demarcated by signs or other methods that establish and inform each employee of the boundaries of the area (29 CFR 1910.1024(e)(2)). Through the May 7, 2018 DFR, OSHA later revised the definition of a BWA so that the requirements apply only where the process or operation involves material containing at least 0.1 percent beryllium by weight (83 FR at 19938).

standards more workable to implement in those sectors while maintaining an overall framework of protections broadly similar to those in general industry.

After publication of the 2017 final rule, on May 7, 2018, OSHA published a direct final rule (DFR) to clarify certain provisions of the beryllium standard for general industry as they related to materials containing trace amounts of beryllium (84 FR 19936). Specifically, the DFR clarified that provisions triggered by dermal contact with beryllium or beryllium contamination would apply only for dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight (83 FR at 19939). OSHA made clear that the agency only intended to regulate contact with trace beryllium to the extent that it caused airborne exposures of concern (83 FR at 19938).

In the 2019 NPRM, OSHA sought to more fully tailor the construction and shipyards standards to the known exposures in these sectors; that is, to abrasive blasting and welding operations. OSHA recognized that, in applying some provisions developed for general industry into the construction and shipyards standards in the 2017 final rule, the agency may have not fully accounted for the trace levels of beryllium in these operations. At the same time, the agency remained open to considering additional sources of exposure. In the NPRM and multiple times at the public hearing, OSHA requested information and data on any additional application groups (industries, occupations, processes, etc.) with potential exposure to beryllium in the construction and shipyards sectors beyond abrasive blasters and welders (84 FR at 53922; Document ID 2222, Tr. 33-35; 44-45; 75-76; 95-96; 125-26).

Although a number of commenters responded to OSHA's request, as outlined above, their comments in many cases relied on anecdotal or unverifiable assertions about additional exposure sources. For example, NABTU and AFL-CIO listed several jobs that they contend

could involve exposure to beryllium, but provided nothing documenting current exposures in these operations. Likewise, NJH indicated anecdotally that they had diagnosed beryllium sensitization and CBD in contractors who had performed work at a primary beryllium facility, but due to the restrictions under the Health Insurance Portability and Accountability Act (HIPAA), they did not disclose any further information about these cases (Document ID 2238, p. 1; 2222, Tr. 65). Such information provides little on which the agency can rely to evaluate these suggested exposure sources.

While commenters did provide some evidence in the form of studies, OSHA believes the studies referenced have limited value in analyzing current exposures to workers in these industries. NABTU (Document ID 2240), AFL-CIO (Document ID 2239, 2244), and NJH (Document ID 2211, 2238) cited a number of studies that they contend demonstrate workers in the construction trades are at risk of exposure to beryllium in greater than trace quantities through work at general industry sites that process or previously processed beryllium. Several of these studies examined beryllium sensitization and CBD among construction trades workers and others who had worked at DOE nuclear weapons facilities. Two studies involved exposures at private facilities. Of the studies submitted, OSHA had previously reviewed Kreiss et al. (1993) and Stange et al. (2001) in the Health Effects section of the preamble to the 2017 final rule (82 FR 2506; 2510).

Kreiss et al. (1993) conducted a screening of current and former workers at a plant that manufactured beryllium ceramics between 1958 and 1975, and then transitioned to metalizing circuitry onto beryllium ceramics produced elsewhere (Kreiss et al. (1993), “Beryllium Disease Screening in the Ceramics Industry” (Document ID 1478)). Five hundred and five of the plant’s then-current and retired workers who had not previously been diagnosed with CBD or

sarcoidosis participated, including 377 current and 128 former workers. Workers' airborne beryllium exposure was not estimated in this survey, and potential for skin contact with beryllium was not explicitly discussed. Surveillance for CBD was conducted on this population in 1989–1990 (Document ID 1478, p. 270).

Kreiss et al. (1993) reported nine newly identified cases of CBD (Document ID 1478, p. 257). The individuals diagnosed with CBD had begun work at the facility between September 1946 and June 1983, with most (7 of 9) hired between 1956 and 1973 (Document ID 1478, Table 2, p. 270). Two cases (11.1 percent) of newly diagnosed CBD occurred among 18 workers who performed ventilation maintenance (Document ID 1478, Table 7, p. 273).¹⁴ However, the authors noted that all workers with CBD who reported work in ventilation maintenance had also reported work in dry pressing and/or process development, job categories which also had particularly high prevalence of CBD (15.8 percent and 13.6 percent, respectively) (Document ID 1478, p. 272; Table 7, p. 273). Moreover, the authors stated that “persons who had worked at dusty tasks in which [beryllium] exposures were harder to control or unlikely to be monitored, such as dry pressing and beryllia process development/engineering, had beryllium disease rates between 11 percent and 16 percent,” rates that “are higher than those described historically in other beryllium industries” (Document ID 1478, p. 273). The authors also noted one case of CBD in an employee who had begun employment eight years after beryllium production ended (a “dust disturber” case) who recalled regularly dry-sweeping for a period of 6 months in 1983 in an area that was later shown to be contaminated by beryllium dust and had no other known source of beryllium exposure (Document ID 1478, p. 271). NJH cited Kreiss et al. (1993) as evidence that

¹⁴ The authors did not provide detail on this ventilation maintenance activity and it is unclear whether such work represents a typical construction activity or a routine general industry maintenance activity.

cleanup workers and tool grinders at general industry sites can face risk from beryllium exposures (Document ID 2211, p. 7).

Virji et al. (2019) published a study of short-term workers employed at a primary beryllium manufacturing facility that processed beryllium salts, beryllium metal and alloys, and beryllium oxide (Virji et al. (2019), “Associations of Metrics of Peak Inhalation Exposure and Skin Exposure Indices with Beryllium Sensitization at a Beryllium Manufacturing Facility” (Document ID 2239)). This study examined a group of 264 short-term workers who were hired after January 1, 1994, and who participated in testing for beryllium sensitization in 1999. The authors used exposure data such as personal full-shift exposure sampling, task and area exposure measurements, and glove measurements to create qualitative and quantitative peak inhalation metrics and skin exposure indices (Document ID 2239, pp. 858-9). The authors reported that their data represent “historical workplace conditions, before the implementation of a redesigned comprehensive prevention program” which included measures to reduce both inhalation and skin exposure through improvements in engineering controls and use of personal protective equipment and clothing; improved housekeeping; measures to minimize migration of beryllium from work areas; and improved health and safety and work practice training, beginning in 2000 (Document ID 2239, pp. 863, 866).

Twenty-six of the study participants (9.8 percent) were beryllium-sensitized, of whom six were also diagnosed with CBD. The authors noted that maintenance work was associated with the highest rate of beryllium sensitization (0.154 per person-year of work in the maintenance category, which had 52.1 person-years of work in total) (Document ID 2239, Table 4, p. 865). The authors found that peak inhalation metrics, indices, and other evidence of skin exposure, and use of material containing beryllium salts were significantly associated with beryllium

sensitization (Document ID 2239, p. 865). It was not possible to distinguish the effects of skin exposure from inhalation exposure because these exposures tended to occur together (Document ID 2239, p. 867). The authors concluded that multiple beryllium exposure pathways and types were associated with sensitization and that efforts to prevent beryllium sensitization should focus on controlling airborne beryllium exposures with particular attention to exposure peaks; process characteristics (the likelihood of upset conditions, which can lead to high short-term exposures); and minimizing skin exposure to beryllium particles, in particular, eliminating skin contact with beryllium salts (Document ID 2239, p. 867).

NABTU and AFL-CIO referenced Virji et al. (2019) in support of their objection to OSHA's proposed removal of dermal protections in the construction and shipyard standards (Document ID 2239, p. 2; 2240, pp. 5-6). NABTU noted that some workers at the beryllium producing facility who were not directly involved in beryllium-related operations nevertheless became sensitized to beryllium; that maintenance work (including shutdown maintenance, as is performed by contract construction workers) was associated with the highest rates of beryllium sensitization; and that the study authors found a strong association between dermal exposure and beryllium sensitization (Document ID 2240, pp. 5-6). NABTU concluded that Virji et al.'s study "lends further support to the need to ensure workers handle their clothing and other personal protective equipment in ways that minimize the potential that either they, their family members or others who may handle the PPE are incidentally exposed." Furthermore, "despite the importance of the required procedures to restrict access to work areas where exposures may exceed the PEL and the presence of a competent person—provisions NABTU fully supports—those protections do not adequately compensate for the potential that beryllium will migrate into other work areas" (Document ID 2240, pp. 5-6). AFL-CIO also commented that Virji et al.

showed the importance of controlling skin exposure to beryllium in order to prevent beryllium sensitization (Document ID 2239, p. 2).

Several of the studies cited by NABTU, AFL-CIO, and NJH examined beryllium sensitization and CBD among construction trades workers and others who had worked at DOE nuclear weapons facilities, including Stange et al. (2001), Sackett et al. (2004), Welch et al. (2004), and Welch et al. (2013). The commenters cited these studies as evidence that construction trades people can be exposed to greater than trace amounts of beryllium while conducting cleanup, demolition, and deconstruction activities in buildings where beryllium was previously released and accumulated in settled dust.

Stange et al. (2001) examined the prevalence of beryllium sensitization and CBD by job category among 5,713 individuals tested in the Rocky Flats Beryllium Health Surveillance Program, which offered surveillance for any current or former employee who believed they may have been exposed to beryllium at the Rocky Flats Environmental Technology Site (Stange, et al. (2001), “Beryllium sensitization and chronic beryllium disease at a former nuclear weapons facility” (Document ID 1403)).¹⁵ Eighty-one cases of CBD and an additional 154 cases of beryllium sensitization were identified among workers for whom job and location (building) histories could be verified (Document ID 1403, p. 408). The prevalence of beryllium sensitization was found to be highest among beryllium machinists (11.4 percent) and health physics technicians (11.9 percent) (Document ID 1403, Table III, p. 410). Cases were also identified among custodial employees (5.64 percent) and other job titles that were thought to have only minimal potential for exposure to beryllium (Document ID 1403, pp. 405, 410). AFL-

¹⁵ In 1991, the Beryllium Health Surveillance Program (BHSP) was established at the Rocky Flats Nuclear Weapons Facility to offer BeLPT screening to current and former employees who may have been exposed to beryllium (Stange et al. (1996), Document ID 0206).

CIO and NJH have referenced Stange et al.'s (2001) findings as evidence that construction work at beryllium-using facilities can involve risk from beryllium exposures (Document ID 2244, p. 3; 0155, p. 3).

Sackett et al. (2004) examined BeLPT results and medical evaluations of 2,221 workers employed at a nuclear weapons facility during decontamination and decommissioning (Sackett et al. (2004), "Beryllium medical surveillance at a former nuclear weapons facility during cleanup operations" (Document ID 1811, Att. 13)). Workers' airborne beryllium exposure was not estimated in the study, and potential for skin contact with beryllium was not explicitly discussed. The authors found 19 cases of beryllium sensitization. Of eight sensitized individuals who underwent full clinical evaluation for CBD, two were diagnosed with CBD. Seven beryllium-sensitized workers were hired after the start of decontamination and decommissioning (Document ID 1811, Att. 13, p. 953). AFL-CIO, quoting a previously submitted comment from the Colorado School of Public Health (Document ID 2136), stated that Sackett et al.'s study showed "that beryllium can cause harm to workers during this process [of decontamination and decommissioning], even when workers have been provided, certified, and trained in the appropriate use of PPE" (Document ID 2244, p. 9). NJH similarly commented that this study demonstrates the potential for exposure during cleanup of beryllium-using sites (Document ID 2211, p. 7).

Welch et al. (2004) presented BeLPT surveillance results among construction trades workers who had formerly been employed at three DOE sites where beryllium was present (Hanford Nuclear Reservation in Richland, Washington; the Oak Ridge Reservation in Oak Ridge, Tennessee; and the Savannah River Site in Aiken, South Carolina) (Welch et al. (2004), "Screening for Beryllium Disease Among Construction Trade Workers at Department of Energy

Nuclear Sites” (Document ID 1815, Attachment 58, p. 207)). Beryllium at these sites had been present in fuel fabrication and R&D (Hanford); from nuclear waste disposal, an antimony-beryllium source rod reactor failure, copper-beryllium tools, chipping of beryllium in glove-box operations, and possible beryllium machining (Savannah River Site); and from assembly and disassembly of nuclear weapons and machining, grinding, and forming of beryllium compounds and alloys (Oak Ridge) (Document ID 1815, Attachment 58, p. 208). The authors examined sensitization among 3842 former workers who completed at least one BeLPT from the screening program’s beginning (1996) through September 30, 2002 (Document ID 1815, Attachment 58, pp. 208, 212; Welch et al (2013), Document ID 2238, Attachment 8, p. 1). Workers’ airborne beryllium exposure was not estimated in the study, nor were surface concentrations of beryllium reported. Welch et al. noted that their study population was “quite different” from previous studies involving concurrently exposed workers in production facilities, “in that the participants are construction workers, and had to have left construction employment at the site to be eligible. Many had left employment years before the examination took place” (Document ID 1815, Attachment 58, p. 214). Moreover, approximately 70 percent of the study population (2,759/3,842) had been hired more than 20 years prior to BeLPT testing (Document ID 1815, Attachment 58, Table VI, p. 214), placing the hire date for the majority of the study population prior to September 30, 1982.

The authors found 54 cases of beryllium sensitization (defined as two abnormal BeLPT results) among the 3,842 tested workers (1.4 percent), and further reported finding a 2.2 percent prevalence of possible sensitization (85 former workers with one or more abnormal BeLPT results). Possible cases occurred among machinists (5.6 percent; 6/107), plumbers/steam fitters (4.1 percent; 5/123), millwrights (3.2 percent; 7/214), sheetmetal workers (2.5 percent; 5/199),

carpenters (2.0 percent; 7/250), pipefitters (2.0 percent; 14/690), electricians (1.8 percent; 13/707), and laborers (1.2 percent; 7/603) (Document ID 1815, Attachment 58, Table IV, p. 213). Five workers were diagnosed with CBD (Document ID 1815, Attachment 58, p. 215).

Welch et al. (2013) published another study of former construction trades workers who had worked at DOE sites, using BeLPT results from DOE's updated screening program, which had been expanded to 27 sites after the publication of Welch et al (2004) (Welch et al. (2013), "Beryllium Disease Among Construction Trade Workers at Department of Energy Nuclear Sites" (Document ID 2238, Attachment 8)). Workers' airborne beryllium exposure was not estimated in the study, nor were surface concentrations of beryllium reported. Welch et al. (2013) did not present information on all study participants' dates of hire or employment, but did report that the mean year of first employment at a DOE site was 1,973 for workers diagnosed with CBD and 1,976 for sensitized workers who were not diagnosed with CBD (Document ID 2238, Attachment 8, Table II, p. 7).

Among 13,810 former construction workers tested as part of the screening program between 1998 and 2010, Welch et al. (2013) identified 189 cases of beryllium sensitization and reported that 28 (0.2 percent) were diagnosed with CBD (of 86 who were medically evaluated) (p. 5). They noted that prevalence of sensitization greater than 2 percent occurred among sheet metal workers (2.4 percent; 19/786), roofers (2.8 percent; 3/108) and boilermakers (2.9 percent; 8/274) (Document ID 2238, Attachment 8, Table IV, p. 8; p. 10).

The authors reported that the 2013 results showed patterns similar to those of the 2004 study in that both the overall rate of beryllium sensitization (1.4 percent) and the prevalence of CBD found among beryllium-sensitized workers were "lower than those reported in a number of other populations, such as currently exposed workers in production facilities." They attributed

these findings to the participants' indirect exposure to beryllium via skin contact with beryllium-contaminated surfaces and with inhalation of re-entrained beryllium dust, rather than from working directly with beryllium in operations such as machining (Document ID 2238, Attachment 8, p. 6). The authors emphasized that their surveillance of construction workers had helped DOE personnel to identify and mitigate those exposures which still exist at the facility and helped focus attention on the risk for beryllium exposure among current demolition workers at these facilities (Document ID 2238, Attachment 8, p. 10). NJH and AFL-CIO pointed to the Welch et al.'s findings in both the 2004 and 2013 studies as evidence that construction trades workers doing contract work in beryllium-using industries face a risk from beryllium exposure (Document ID 2211, p. 7; 2244, p. 9).

OSHA has reviewed each of the studies submitted by the commenters. Each of the studies support OSHA's determination that beryllium exposure presents a serious risk of material health impairment to workers. However, OSHA finds that the studies are of limited value in determining current exposures faced by those construction and shipyards workers covered by the beryllium standards for two reasons. First, as acknowledged by NJH (Document ID 2238, p. 1), the studies do not contain relevant exposure data. Such data would be needed to characterize the airborne and/or dermal exposures of workers in those studies, to evaluate with reasonable accuracy the processes and operations where significant beryllium exposures may have led to cases of beryllium sensitization and CBD, and to determine whether those same processes and operations would be likely to contribute to workers' risk in current-day facilities. This was the same reason that OSHA determined in the 2017 final rule that it could not develop exposure profiles for some of these same operations (see 82 FR at 2639).

Perhaps more importantly, OSHA doubts that these studies reflect current conditions in general industry facilities. The studies appear to primarily involve populations with many members exposed before the 1990s, when the use of the BeLPT in screening for CBD led both DOE and some private firms to adopt and increasingly strengthen beryllium exposure control strategies.¹⁶ The studies evaluating former construction trades workers largely involve populations who were first exposed before DOE and private industry sites—such as those studied by Kreiss et al (1993) and Virji et al. (2019)—began to strengthen exposure controls in the mid-1990s, and long before OSHA issued comprehensive beryllium standards in 2017. As noted above, approximately 70 percent of the study population (2,759/3,842) had been hired more than 20 years prior to BeLPT testing (Document ID 2238, Attachment 8, Table VI, p. 214), placing the hire date for the majority of the study population prior to September 30, 1982.

Importantly, these studies do not account for the effect of OSHA’s beryllium standard for general industry (29 CFR 1910.1024), which addresses the primary sources of exposure in these studies—insufficiently controlled beryllium-releasing processes and settled or re-entrained dust containing beryllium—and is designed to drastically reduce beryllium exposures in general industry facilities. To comply with its obligations under the general industry standard, the host employer at a general industry site today will have implemented beryllium work areas or regulated areas around processes that create beryllium exposures of concern (29 CFR 1910.1024(e)), will have instituted engineering controls and work practices to control exposures (29 CFR 1910.1024(f)), and will have implemented housekeeping measures that will prevent the

¹⁶ In DOE and in private industry, general awareness of beryllium-related risks at airborne levels lower than the previous OSHA PEL of 2 ug/m³ was low until the early 1990s, when use of the BeLPT by researchers such as Kreiss et al. brought greater understanding of the need to better control beryllium exposures. By 1993, beryllium had been identified as a significant source of occupational disease risk within the DOE complex, and by 1996, DOE had established an interim Chronic Beryllium Disease Prevention Program rule, which was finalized in 1999 (Document ID 2238, Attachment 8, pp. 1-2).

accumulation or re-entrainment of settled dust containing beryllium (29 CFR 1910.1024(j)).

These measures, combined with the general industry employer's duty under the hazard communication standard to inform any construction employer entering the area of the potential for hazardous beryllium exposure and the precautionary measures needed to protect employees (29 CFR 1910.1024(m); 29 CFR 1910.1200(e)(2)), are designed to ensure that construction employees entering the general industry site are not exposed to active beryllium-releasing processes or accumulated beryllium in the work area and are able to avoid any remaining risk of beryllium exposure.

In sum, the most that these studies can tell us is that in the past, construction employees at general industry sites with beryllium exposure from poorly controlled processes became sensitized to beryllium and, in some cases, developed CBD. This information supports OSHA's determination that beryllium exposure presents a serious health risk. It does not, however, demonstrate that construction employees who enter a general industry site today—with the engineering and work practice controls, housekeeping, and other requirements of the beryllium general industry standard—will be exposed to and require protection from dermal contact with beryllium in more than trace amounts.

With respect to potential exposure from the dressing or sharpening of beryllium-containing non-sparking tools, NJH (Document ID 2211, p. 7; 2238, p. 2) referred OSHA to two studies by Mikulski et al. that found exposure to beryllium through machining and grinding of copper-beryllium (Cu-Be) 2 percent alloy tools, even when done only occasionally, was associated with increased risks of beryllium sensitization (“Risk of Beryllium Sensitization in a Low-Exposed Former Nuclear Weapons Cohort from the Cold War Era” (2011a) (Document ID 2238, Attachment 4); “Prevalence of Beryllium Sensitization Among Department of Defense

Conventional Munitions Workers at Low Risk for Exposure. *Journal of Occupational and Environmental Medicine*” (2011b) (Document ID 2238, Attachment 5)). These studies reported the results of a DOE program that screened former workers at a nuclear weapons assembly site for beryllium sensitization as part of that agency’s Former Worker Program established in 1996. The site in question operated beginning in 1941 as a Load, Assembly and Pack (LAP) facility for the Department of Defense (DOD) conventional munitions operations; from 1949 to mid-1975 it was shared with DOE for production of nuclear weapons; and in 1975 DOE activities ceased at this site (Document ID 2238, Attachment 4, p. 195).

Although OSHA acknowledges the findings of the Mikulski studies, which involved exposures at a DOD facility prior to 1975, comments and hearing testimony received in response to the NPRM suggest that the dressing or sharpening of non-sparking tools is not an exposure source of concern for workers in the construction and shipyards sectors covered by the beryllium standards. At the public hearing, NABTU—which had earlier in the rulemaking process raised concerns about exposure from such tools (Document ID 2202, p. 19)—indicated that they had attempted but were not able to find specific examples of construction trades workers dressing or sharpening non-sparking tools (Document ID 2222, Tr. 88). Likewise, when asked about the prevalence of these tools in construction, the representative from USW stated that he had personally used beryllium-containing non-sparking tools on a few occasions many years ago, but that he could only speculate as to how often they are used today. He further testified that he did not know why one would use these tools over other non-sparking tools that do not contain beryllium (Document ID 2222, Tr. 32-34).

Other commenters raised doubts about the extent of exposure from non-sparking tools. The SCA identified the use of non-sparking tools in shipyards, but noted that these are

“infrequently used, and intermittent” (Document ID 2204, p. 2). SCA did not identify how often or by whom these tools are dressed or sharpened, which, as the representative from USW recognized (Document ID 2222, Tr. 32), is the process during which beryllium exposure might occur. Materion, while noting that they do not serve the non-sparking tool market, stated that the dressing of non-sparking tools could result in exposure to beryllium above the action level but also noted that the other primary producer of copper beryllium—which does serve that market—has a program through which its customers can return their non-sparking tools for sharpening at no cost (Document ID 2237, p. 3). That exposure from this source is unlikely is supported by exposure data in the record, submitted by the Navy and private shipbuilding establishments, showing that the primary exposure source in shipyards is abrasive blasting with some additional exposures during welding operations (Document ID 0144, p. 3-4; 0145; 1166).¹⁷

OSHA continues to recognize the possibility that some construction and shipyard workers could be exposed to beryllium through activities other than abrasive blasting and welding. However, the record continues to lack key data about these potential exposures, including how often the exposures occur, who is exposed, the duration of the exposures, the type and extent of exposure, or any controls that may be in place to address them. Without this data, OSHA lacks sufficient information to characterize the nature, locations, or extent of beryllium exposure in application groups other than abrasive blasting with beryllium-containing slags and certain welding operations. Importantly, with respect to commenters’ assertion that these

¹⁷ Some commenters also stated that potential sources of beryllium exposure in these sectors include work at landfills that receive beryllium-containing materials (Document ID 2202, Attachment 1, p. 2); work on high-tech aircraft and submarines (Document ID 2208, p. 6); and work as machinists and surveyors (Document ID 2210, p. 4). OSHA notes that many of these categories would appear to be jobs that are not covered by the construction or shipyards standards, either because they are likely covered by the general industry standard or because they relate to “uniquely military equipment, systems, and operations” (see Executive Order 12196; 29 CFR 1960.2(i)). Regardless, as with the other operations identified, the record lacks data from which OSHA could evaluate exposures in these operations.

additional exposures include a risk solely from dermal contact with more than trace beryllium, either from construction work at general industry sites that handle beryllium or through the use of non-sparking tools, OSHA finds that the record does not demonstrate that this continues to be a concern, for the reasons already discussed.

Therefore, the agency finds that it is appropriate at this time to tailor certain aspects of the final standards—such as the written exposure control plan requirements—to those operations for which the agency has sufficient data to demonstrate worker exposure to beryllium at levels of concern, to properly characterize and evaluate the exposures, and to develop appropriate measures to address them. By ensuring that these provisions of the beryllium standards for construction and shipyards are no more complex or onerous than is needed to protect workers, OSHA believes the final standards will improve compliance and thereby more effectively protect these workers.

At the same time, OSHA disagrees with industry commenters who contend that the protections of the beryllium standards for construction and shipyards should only apply to abrasive blasters and welders. OSHA maintains that all beryllium-exposed workers in construction and shipyards should be afforded protections from beryllium exposure (see 84 FR at 51377) and, to the extent that exposures from sources other than abrasive blasting and welding do occur, the beryllium standards for construction and shipyards continue to provide these protections. Both standards continue to apply to all occupational exposure to beryllium that meets the requirements of paragraph (a). OSHA declines to adopt CISC's suggestion that the agency simply incorporate new requirements into paragraph (f) of the ventilation standard for construction (29 CFR 1926.57), so as to apply them only to abrasive blasters, as this would leave unprotected employees who might be exposed in operations OSHA has not identified or in the

future. This is consistent with OSHA's typical approach to substance-specific standards, which generally apply broadly to all occupational exposure to a substance, rather than to particular operations (see, e.g., 29 CFR 1926.1126(a)(1) (Chromium (IV)); 29 CFR 1926.1127(a) (Cadmium); 29 CFR 1910.1028(a)(1) (Benzene); 29 CFR 1910.1053(a) (Respirable Crystalline Silica)). With respect to CISC's assertion that construction employers will have to evaluate every task and material on their worksite to determine whether beryllium is present in trace amounts (Document ID 2203, p. 16), the agency emphasizes that this is not the case. Although the beryllium standard applies to occupational exposure to beryllium in all forms, compounds, and mixtures in the construction industry, paragraph (a)(3) exempts from coverage materials containing less than 0.1 percent beryllium by weight where the employer has objective data demonstrating that employee exposure to beryllium will remain below the action level of 0.1 $\mu\text{g}/\text{m}^3$, as an 8-hour time weighted average, under any foreseeable conditions. As explained below, apart from certain abrasive blasting media, those materials at the typical construction site that the agency has identified as containing beryllium in trace amounts (i.e. rock, soil, concrete, and brick) are not likely to release airborne beryllium above the action level under foreseeable conditions and therefore do not typically trigger the requirements of the standard. Further, for any additional materials containing comparably low levels of beryllium, an employer may rely on objective data that employees will not be exposed above the PEL for total airborne dust to qualify for the exemption under paragraph (a)(3).

OSHA's analysis of its own sampling data demonstrates that exposures from rock, soil, and concrete are highly unlikely to exceed the action level in typical circumstances (see Beryllium Air Samples at Construction Sites: An Analysis of OSHA OIS Sample Results 2012-2018, Document ID 2235). This data shows that, given the low levels of beryllium in rock, soil,

and concrete, airborne dust concentrations would have to be extremely high for exposures to even approach the beryllium action level. The same is true for brick, which may contain beryllium in trace amounts comparable to these materials.¹⁸ These dust concentrations would typically exceed the PEL for total airborne dust, or particulates not otherwise classified (PNOC), long before the beryllium action level is reached. In the case of concrete, the level of airborne dust required to reach the beryllium action level would also surpass the PEL for crystalline silica many times over. Thus, the action level would only be reached under extremely dusty conditions—such as those produced during abrasive blasting operations—that would also exceed the PELs for PNOC and crystalline silica.

OSHA considers this data sufficient to demonstrate that exposure to rock, soil, concrete, and brick at the typical construction site will not result in beryllium exposure above the action level under foreseeable conditions. As such, when performing tasks at the typical construction site, exposure to these materials will not trigger the requirements of the beryllium standard. Outside of these materials and certain abrasive blasting media, OSHA is not aware of any other building materials at the typical construction site that contain beryllium. However, for any material containing comparable levels of beryllium, an employer may rely on objective data that exposures in its operations are consistently below the PEL for PNOC to demonstrate that exposure from these materials would not exceed the beryllium action level under foreseeable conditions.

The agency notes that if a construction employer has reason to believe that the materials at its particular worksite contain beryllium at levels significantly above average or that a

¹⁸ The beryllium content of soil and rock averages less than 2 ppm while the beryllium content of concrete is typically less than 1 ppm (Document ID 2235, pp. 2, 6). Some bricks may contain up to 50 percent fly ash, which in turn may contain beryllium in trace amounts (see 2017 FEA, Document ID 2014, pp. IV-651 to IV-652).

particular process produces abnormally high levels of dust such that beryllium exposure might foreseeably reach the action level (e.g., where total dust is likely to exceed the PEL for PNOC), that employer would be required to comply with the applicable provisions of the beryllium standard. These circumstances, however, will not be typical of the average construction site.

OSHA also disagrees with commenters such as NABTU (Document ID 2240, p. 2) who suggest that the agency has abandoned its prior position regarding the coverage of the construction and shipyards standards. While OSHA acknowledged in the 2017 final rule the “potential for exposure” outside of abrasive blasting and welding and determined that any such exposure should be covered by the beryllium standards for construction and shipyards (a position the agency maintains), OSHA made no finding in the 2017 final rule that workers in the construction industry are currently at risk from dermal contact at general industry sites or from the dressing or sharpening of non-sparking tools. On the contrary, the agency was clear that it lacked data to characterize or quantify exposures from additional sources (82 FR at 2639). The agency’s finding in this rulemaking that these particular sources of exposure are likely not a concern in the construction and shipyards sector is not a change from its previous position, as the agency took no position on the issue in the 2017 final rule. Where OSHA did originally include provisions aimed solely at dermal contact in the construction and shipyards standards that it now intends to remove, this was due to the agency borrowing provisions from the general industry standard without appropriately accounting for the trace exposures in abrasive blasting and welding as they pertain to dermal contact.¹⁹ Inclusion of these provisions was not based on a

¹⁹ As has been noted, the agency did specifically tailor some provisions to abrasive blasting; for example, deciding not to extend the beryllium work area requirements of the general industry standard to construction and shipyards. In that case, commenters specifically identified the requirement as unworkable when dealing with materials containing beryllium in trace amounts (see 82 FR at 2661).

finding by OSHA that the provisions were necessary to address exposures beyond abrasive blasting and welding.

At the same time, some commenters misconstrue the agency's focus on the "primary" sources of exposure as the agency ignoring the possibility of different exposures. This is not the case. Rather, OSHA finds that the standards as revised will maintain protections in all likely exposure scenarios while more appropriately addressing the operations from which exposures regularly occur. This approach is consistent with the agency's position in the 2017 final rule, as evidenced by the agency's decision at that time to tailor several provisions of the standards to abrasive blasting operations, as discussed above.

With respect to the USW's assertion that OSHA must consider potential future uses of beryllium that do not currently exist (Document ID 2222, Tr. 18-19), the agency agrees and again emphasizes that the beryllium standards for both construction and shipyards continue to apply to all beryllium exposures, present or future, that meet the requirements of paragraph (a). At the same time, OSHA declines to fashion the standards around hypothetical exposures which the agency cannot quantify or evaluate, rather than around those operations for which it has data. The agency remains free to further revise the standard in the future if new processes or uses of beryllium warrant such a change.

The agency also notes that the inability of stakeholders to provide relevant data on exposures outside of abrasive blasting and welding, suggests that such exposures, if they occur, are rare. As such, acknowledging the possibility of these exposures does not alter OSHA's previous analysis with respect to the economic and technological feasibility of the beryllium standards for construction and shipyards. OSHA has no reason to believe that these rare exposures, if they occur, would mean that compliance with the PEL can no longer be met in most

operations most of the time or that the beryllium standards will now imperil the existence of the construction and shipyards industries (see 82 FR at 2583).

In summary, after considering the comments received and the record as a whole, the agency has determined that it is appropriate to tailor certain ancillary provisions of the beryllium standards for construction and shipyards to abrasive blasting and welding operations, the two operations for which it has relevant data. At the same time, the agency maintains its position that the construction and shipyards standards should continue to apply to all occupational exposure to beryllium in these sectors. Based on the record, OSHA has determined that the standards, as revised, continue to address the known exposures of concern in the construction and shipyards sectors, as well as potential exposures outside of abrasive blasting and welding operations, and will not result in reduced protections for workers in these industries. This is true with respect to the proposed revisions to paragraph (f)(1), as well as to other revisions proposed on the basis that the primary beryllium exposures in construction and shipyards take place during abrasive blasting and welding operations. OSHA remains open to revisiting these issues in the future and continues to welcome data and information on additional operations with potential exposure to beryllium in the construction and shipyards sectors.

In addition to the comments regarding exposure to beryllium in contexts other than abrasive blasting and welding, one commenter further challenged the agency's preliminary determination that welding in shipyards is not likely to produce skin exposures of concern. Specifically, USW stated, "OSHA acknowledges that welding with beryllium-copper rods and wire can expose workers to beryllium, but dismisses the hazards of dermal contact on the grounds that such contact with materials exceeding 0.1 percent is unlikely. However beryllium-copper rods typically contain 2 percent beryllium" (Document ID 2212, p. 3).

With respect to the limited welding operations in shipyards, OSHA explained in the NPRM that, although these operations may involve base materials or fume containing more than 0.1 percent beryllium by weight, OSHA has reason to believe that skin or surface contamination is not an exposure source of concern. Specifically, a 2007 study by Cole indicated that the beryllium content of beryllium aluminum alloy welding fume samples was lower than expected given the beryllium content of the base metal (84 FR at 53906). One commenter, USW (Document ID 2212), took issue with OSHA's preliminary determination with respect to welding. However, they did not discuss the Cole study, nor provide additional evidence to contradict OSHA's position with respect to skin and surface contamination in this operation.

USW pointed to an information sheet on beryllium copper welding wire and rods published by U.S. Alloy Company that, it claimed, "warns users against grinding, cutting, or polishing [a] weld without proper protection" (Document ID 2212, p. 3; Attachment A). According to USW, "welds are often subjected to the operations the manufacturer warned against, sometimes by workers other than welders, and there is no indication that OSHA considered them" (Document ID 2212, p. 3). However, the information sheet USW provided nowhere mentions a dermal contact risk from these welding rods. Rather, it states that "care should be taken to avoid inhaling the welding fumes," including "purging the area by drawing off any of the fumes with smoke eaters and having the operators wear a mask" (Document 2212, Attachment A). Importantly, the portion to which USW refers reads "[d]ust or fumes generated by machining, grinding, sawing, blasting, polishing, buffing, brazing, soldering, welding or thermal cutting of the casting can produce *airborne contaminants that are hazardous*" (Document 2212, Attachment A) (emphasis in the original). Rather than demonstrating a dermal contact risk from beryllium copper welding wire and rod, OSHA finds that the lack of any

mention of such a risk in the manufacturer's information sheet supports OSHA's finding that such exposures are not a concern in this context.²⁰

Comments Specific to Paragraph (f)(1)

In addition to these broader comments about the appropriate application group in the construction and shipyards sectors, OSHA received a number of additional comments specifically addressing the written exposure control plan requirements of paragraph (f)(1). Two stakeholders commented broadly on the importance of written exposure control plans. The AFL-CIO and NABTU stated that written exposure control plans are essential to providing employers with a clear plan for exposure identification and control (Document ID 2210, p. 6; Document ID 2202, p. 5). NABTU emphasized the importance of the written plan's description of engineering controls, work practices, and substitute materials for each task and a description of how employers will protect workers not engaged directly in beryllium-exposed tasks, by limiting access to work areas where beryllium-exposed tasks such as abrasive blasting occur (Document ID 2202, p. 6). Without a written plan, both groups asserted, employers are unlikely to adequately control beryllium exposure (Document ID 2210, p. 6; Document ID 2202, p. 6). NABTU further emphasized that when planning for worker protection during tasks involving beryllium, employers must account for the unique toxicity of beryllium by creating a written exposure control plan specifically addressing beryllium exposures (Document ID 2202, p. 5).

The remainder of this section details the comments received with respect to each proposed revision in paragraph (f)(1) and provides OSHA's final determination.

²⁰ NJH also commented that coal slag may contain more than trace amounts, citing a study by the Center to Protect Workers' Rights (CPWR) that "found that beryllium was present at a concentration of 4 parts per million (ppm) in coal slag samples analyzed prior to blasting, and measured airborne beryllium concentrations of up to 9.5 µg/m³ during abrasive blasting tasks, far above trace amounts" (Document ID 2211, p. 7). OSHA notes that 4 ppm, or 0.0004 percent by weight, is well under the 0.1 percent beryllium by weight that OSHA treats as "trace" for the purposes of these standards (82 FR at 2610).

OSHA's proposed revisions to paragraph (f)(1)(i)(A) received no comment apart from the general concerns discussed above regarding OSHA's assessment of beryllium exposures outside of abrasive blasting and welding. Therefore, OSHA is finalizing its proposal to modify paragraph (f)(1)(i)(A) to refer simply to "exposure" rather than "airborne exposure to or dermal contact with" by removing the words "airborne" and "or dermal contact with" as qualifiers for exposure to beryllium. OSHA notes that these changes are consistent with other paragraphs where the agency is simplifying the language in a similar manner (e.g., paragraphs (k)(3)(ii)(A) and (k)(4)(i), Medical surveillance), and is not intended to alter the meaning of the provision.

OSHA is also finalizing its proposal to revoke paragraphs (f)(1)(i)(B) and (C) of both the construction and shipyards standards, which previously required lists of operations and job titles involving exposure above the action level and above the TWA PEL or STEL, respectively. OSHA's proposals to revoke these paragraphs received little comment apart from the general concerns discussed above regarding the potential for exposures in contexts other than abrasive blasting and welding. As discussed there, OSHA has concluded that it is appropriate to tailor certain aspects of the beryllium standards for construction and shipyards to the limited number of operations known to involve beryllium exposure in construction and shipyards. Given the small number of operations with known beryllium exposure in these industries, OSHA maintains that the operations and job titles in these categories would be largely the same as those for which exposure to beryllium is reasonably expected. OSHA therefore believes it sufficient to require that an employer identify those operations and job titles that result in exposure to beryllium in any form and that fall within the scope of the standards, and that any additional lists would be unnecessary and redundant.

With respect to OSHA's proposal to add a new paragraph in both the construction ((f)(1)(i)(E)) and shipyards ((f)(1)(i)(D)) standards to require that the written exposure control plan include procedures used to ensure the integrity of each containment used to minimize exposures to employees outside the containment, no commenter objected to the addition of this requirement, while NJH supported it (Document ID 2211, p. 8). As OSHA explained in the NPRM, this requirement will ensure that any containment used is not compromised such that employees outside of the containment are potentially exposed to beryllium at levels above the TWA PEL or STEL. The need for this requirement is reinforced by comments from USW identifying issues with gaps and leaks from "make shift containment" (Document ID 2124, page 10) and noting that beryllium can escape from abrasive blasting containments (Document ID 2222, Tr. 27-28). After considering the comments and the record as a whole, OSHA is finalizing this provision as proposed.

AFL-CIO disagreed with OSHA's proposal to remove paragraphs (f)(1)(i)(D) and (E) of the standards, which required the employer to include in the written exposure control plan procedures for minimizing cross-contamination and migration of beryllium within or to locations outside the workplace. AFL-CIO characterized these provisions as "essential to reduce cumulative exposure to beryllium for workers in high exposure operations and to protect other workers who do not perform beryllium tasks but would be exposed to beryllium due to the lack of cross contamination and migration minimization procedures" (Document ID 2210, p. 6).

AFL-CIO also argued that OSHA's proposed requirement for written exposure control plans to include procedures used to ensure the integrity of each containment used to minimize exposures to employees outside of containments would be insufficient to control the migration of beryllium (Document ID 2210, p. 6). AFL-CIO stated that "OSHA is requiring containments that

would create a higher concentration of beryllium dust inside the enclosure [and] relying on the protection of PPE,” while revising paragraph (f) and paragraphs (h)(2) and (3) to no longer require employers to use specific procedures to ensure that PPE is safely doffed. According to AFL-CIO, this will increase the cumulative exposure risk for abrasive blasters and increase the risk of cross-contamination and migration of beryllium, thereby exposing workers with no respiratory or dermal protection (Document ID 2210, p. 7).

OSHA disagrees, firstly, with AFL-CIO’s contention that the proposed requirement for written exposure control plans to include procedures used to ensure the integrity of each containment would lead to increased beryllium exposures to workers inside the enclosure. This final rule does not require the use of containments, but rather requires that when an employer chooses to use a containment, it is used in such a way that employees outside of the containment are not exposed to beryllium at levels above the TWA PEL or STEL. In other words, this requirement merely ensures that containments, when used, accomplish their intended function. Workers inside the containment continue to receive the protections of the requirements for use of PPE (paragraph (h)(1)) and respiratory protection (paragraph (g)(1)(ii)-(iii)), as well as the requirements that PPE not be removed or cleaned in a manner that releases beryllium into the air (paragraph (h)(2)(ii), (h)(3)(ii)). For this reason, OSHA finds that adding a requirement that the written control plan include such procedures will not lead to increased beryllium exposures to workers inside such containments.

Furthermore, OSHA disagrees with AFL-CIO’s position that the previous requirements to document procedures for minimizing cross-contamination and migration in the written exposure control plan are necessary to protect workers in the context of the specific exposures in construction and shipyards sectors. In the general industry context, requirements relating to

cross-contamination and migration serve to address concerns about both airborne and dermal exposures (see 82 FR at 2668-69). At the same time, OSHA has explained that it does not intend provisions aimed at protecting workers from the effects of dermal contact to apply in the case of materials containing only trace amounts of beryllium absent significant airborne exposures (84 FR at 53906). OSHA maintains that the primary exposures in construction and shipyards are from abrasive blasting with material containing trace amounts of beryllium and limited welding operations. Moreover, as explained above, while the agency recognizes the potential for other exposure sources in these sectors, the record does not demonstrate that potential exposures involve a risk of dermal contact to beryllium in more than trace amounts.

In the 2017 final rule, OSHA tailored portions of the written exposure control plan requirements in construction and shipyards to the particular exposures in abrasive blasting operations. Specifically, the agency chose not to include in the construction and shipyards standards a requirement that employers keep surfaces as free as practicable of beryllium, as it had done in the general industry standard, finding that such a requirement would be impracticable in abrasive blasting operations (82 FR at 2669). At the same time, the agency applied other provisions, developed for the general industry context, without appropriately accounting for the trace amounts of beryllium in the construction and shipyards sectors. In these sectors, where the record evidence on dermal exposure in modern-day worksites is limited to trace amounts of beryllium and where the agency otherwise has reason to believe dermal contact is not an exposure source of concern, OSHA now finds that it is appropriate to further tailor these provisions to focus on ensuring that workers not involved in beryllium-related operations are not exposed to airborne beryllium in excess of the PELs.

Several provisions of both standards work together to protect workers near abrasive blasting and welding operations from exposures above the PELs. In the construction standard, the written exposure control plan must include procedures to restrict access to work areas where exposures to beryllium could reasonably be expected to exceed the TWA PEL or STEL (renumbered in this final rule as paragraph (f)(1)(i)(D)), and the requirement that these procedures are to be implemented by a competent person (paragraph (e)(2)). In the shipyard standard, requirements for regulated areas (paragraph (e)) require that employers designate areas where exposures to beryllium could exceed the PELs and limit access to authorized employees. OSHA has retained these requirements in this final rule. Further, the housekeeping requirements of both standards (paragraph (j)) require cleaning methods that minimize the likelihood of re-entrainment of beryllium-containing dust when cleaning up dust produced by abrasive blasting operations.

In addition, as discussed above, OSHA is finalizing its proposal to add a new paragraph in both the construction ((f)(1)(i)(E)) and shipyards ((f)(1)(i)(D)) standards to require that the written exposure control plan include procedures used to ensure the integrity of each containment (such as tarps or structures used to keep sandblasting debris within an enclosed area) used to minimize exposures to employees outside the containment. This requirement will further limit airborne exposures for employees outside of the containment where an employer uses a containment. Finally, both standards require the employer to ensure that personal protective clothing and equipment required by the standard is not removed in a manner that disperses beryllium into the air (paragraph (h)(2)(ii)), which will serve to limit migration of beryllium and reduce airborne exposure from re-entrainment.

With respect to the AFL-CIO's assertion that procedures regarding the integrity of containments are insufficient to protect workers, OSHA makes two points. First, comments in the record indicate that containments can be effective in containing dust during abrasive blasting, if appropriate procedures are used to ensure their integrity. As noted by the USW and AFL-CIO, there are times that the abrasive blasting media can compromise the integrity of the containment (Document ID 2124, pp. 10-11, 13; 1756, Tr. 246-49; 2210, p. 6). However, under these circumstances OSHA expects that operations would be suspended to repair the containment. According to the testimony from USW during the public hearing for the 2017 final rule, this practice already takes place in some shipyard operations (Document ID 1756, Tr. 262-63). USW further identified the use of negative pressure with containments as a feasible and effective way to ensure their integrity; a method that is already used in the context of bridge repair (Document ID 1756, Tr. 264).

Second, OSHA reiterates that it does not intend for the added provision on containments alone to protect workers from exposures exceeding the PEL. Rather, the agency intends this added provision to complement the written plan's procedures to restrict access to work areas where exposures to beryllium could reasonably be expected to exceed the TWA PEL or STEL (renumbered as paragraph (f)(1)(i)(D) of the construction standard), the requirement that these procedures are to be implemented by a competent person (paragraph (e)(2) of the construction standard) and requirements for regulated areas (paragraph (e) of the shipyard standard), to ensure that workers not directly involved in beryllium-related operations would not be exposed to beryllium above the PELs.

OSHA has determined that these requirements will adequately ensure that workers in shipyards and construction not directly involved in beryllium-related work will not be exposed to

beryllium in excess of the TWA PEL or STEL, and is therefore finalizing its proposal to revoke the requirements that the employer include in the written exposure control plan procedures for minimizing cross-contamination (former paragraph (f)(1)(i)(D)) and procedures for minimizing the migration of beryllium within or to locations outside the workplace (former paragraph (f)(1)(i)(E)).

The AFL-CIO also disagreed with OSHA's proposal to remove paragraph (f)(1)(i)(H), which in the 2017 rule required employers to document procedures for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated PPE, from the written exposure control plan. The AFL-CIO argued that these procedures protect workers from further exposing themselves to beryllium when putting on and removing PPE and prevent cross-contamination and migration of beryllium to other areas of the worksite (Document ID 2210, p. 6). NJH similarly argued that procedures should be in the written exposure control plan to identify and minimize beryllium exposures to workers involved in cleaning and maintaining PPE, as well as containments. If exposures are generated in a process, they stated, then PPE to protect the worker is contaminated and should be handled as required in the 2017 final rule (Document ID 2211, p. 9).

OSHA disagrees with the AFL-CIO and NJH that all of the 2017 final rule's requirements for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated PPE are necessary in the construction and shipyards context. As OSHA explains in the summary and explanation for paragraph (h), Personal Protective Clothing and Equipment, OSHA has determined that it is appropriate to remove certain requirements pertaining to laundering, storing, and disposal of PPE from the construction and shipyard standards. Specifically, OSHA is removing three provisions from paragraphs (h)(2) and (3): the

requirement to ensure that each employee stores and keeps beryllium-contaminated PPE separate from street clothing and that storage facilities prevent cross-contamination as specified in the written exposure control plan (paragraph (h)(2)(iii)); to ensure that PPE removed from the workplace for laundering, cleaning, maintenance, or disposal be placed in closed, impermeable bags or containers labeled in accordance with the standards' employee information and training requirements and the Hazard Communication standard (paragraph (h)(2)(v)); and to inform, in writing, any person or business entity who launders, cleans, or repairs PPE required by the standards of the potentially harmful effects of exposure to airborne beryllium and dermal contact with beryllium, and of the need to handle the PPE in accordance with the standards (paragraph (h)(3)(iii)). OSHA is removing paragraph (h)(2)(iii) because it applies only to "beryllium contaminated" PPE (i.e., contaminated with beryllium in concentrations greater than or equal to 0.1 percent by weight), and thus would never be triggered by the operations to which OSHA is tailoring these standards and because the sanitation standards applicable to construction and shipyards provide the necessary protections for the storage of PPE (see further discussion below in the summary and explanation for paragraph (i)). OSHA is removing paragraphs (h)(2)(v) and (h)(3)(iii) because they protect downstream handlers of PPE who (to OSHA's knowledge) are not engaged in any tasks that could generate airborne exposures at levels of concern.

Accordingly, OSHA has determined these provisions are unnecessary and should be removed.

In light of OSHA's decision to eliminate several of the requirements in paragraph (h), OSHA believes that it is unnecessary to require the employer to document all of the procedures that were previously included in paragraph (f)(1)(i)(H). However, OSHA finds that it is appropriate to retain those requirements of paragraph (f)(1) that pertain to provisions that OSHA has not eliminated. Specifically, the construction and shipyards standards still require the

employer to ensure that PPE required by the standard is not removed in a manner that disperses beryllium into the air (paragraph (h)(2)(ii)). Both standards still require the employer to ensure that all reusable personal protective clothing and equipment required by this standard is cleaned, laundered, repaired, and replaced as needed to maintain its effectiveness (paragraph (h)(3)(i)). And, both standards still require the employer to ensure that beryllium is not removed from PPE required by the standard by blowing, shaking or any other means that disperses beryllium into the air (paragraph (h)(3)(ii)). In addition, OSHA has decided to revise former paragraph (h)(2)(iv) (renumbered as (h)(2)(iii)) to require that the employer ensure that no employee with reasonably expected exposure above the TWA PEL or STEL removes personal protective clothing or equipment from the worksite unless it is first cleaned in accordance with paragraph (h)(3) (see the Summary and Explanation for paragraph (h)).

OSHA's 2017 final rule would have required employers in construction and shipyards to include information pertaining to these provisions in their written exposure control plans. For these provisions, OSHA agrees with the aforementioned commenters that paragraph (f)(1) should retain the documentation requirements that were promulgated in the 2017 final rule. Therefore, OSHA is adding a requirement for employers to include, in their written exposure control plans, procedures for removing, cleaning, and maintaining personal protective clothing and equipment in accordance with paragraph (h) of this standard. Specifically, OSHA is finalizing its proposal to remove paragraph (f)(1)(i)(H), and is adding a new paragraph (f)(i)(F) to each standard, instructing employers that their written exposure control plans must include such procedures.

NABTU also expressed its belief that OSHA must retain the standards' procedures for minimizing cross-contamination and migration of beryllium, and urged OSHA to retain paragraph (f)(1)(i)(H) (Document ID 2240, pp. 5-6). In support, NABTU noted that some

workers at a beryllium producing facility studied by Virji et al. (2019) who were not directly involved in beryllium-related operations nevertheless became sensitized to beryllium, including some involved in shutdown maintenance, and that the study authors found a strong association between dermal exposure and beryllium sensitization (Document ID 2240, pp. 5-6). As discussed above in this Summary and Explanation for paragraph (f)(1), OSHA does not agree that the Virji study indicates that employees in the construction and shipyards industries are currently exposed to dermal contact with beryllium in greater-than-trace concentrations. OSHA has determined that it is appropriate to tailor these standards to abrasive blasting and welding operations, and preventing cross-contamination and migration of beryllium-containing dust in such operations, where the dust contains only trace amounts of beryllium, is only necessary to prevent beryllium-containing dust from being re-entrained and creating an additional inhalation risk to workers who already have airborne exposure to beryllium at levels of concern (e.g., workers in and around beryllium-releasing operations, rather than workers in distant areas of the worksite or downstream from beryllium-releasing operations).

OSHA received one comment on its proposal to revise paragraph (f)(1)(ii)(B) to refer simply to “exposure to” rather than “airborne exposure to or dermal contact with” beryllium (84 FR at 53911), consistent with other paragraphs in which OSHA proposed to simplify the language in a similar manner (e.g., paragraph (f)(1)(i)(A), Written exposure control plan; paragraphs (k)(3)(ii)(A) and (k)(4)(i), Medical surveillance). As revised, the paragraph requires the employer to review and evaluate the effectiveness of each written exposure control plan and update it, as necessary, when notified an employee shows signs or symptoms associated with exposure to beryllium. NJH agreed that the proposed change would simplify the reading of the

standard (Document ID 2211, p. 9). Having received no comments opposing this change, OSHA is finalizing this provision as proposed.

NJH also suggested that if OSHA makes this change, the agency should also provide a definition of the term “exposure” (Document ID 2211, p. 9). OSHA disagrees. The term “exposure” and closely related terms such as “exposed” appear in nearly every paragraph of the standard, referring variously to airborne exposure, dermal exposure, or both. OSHA has carefully written the regulatory text and the accompanying summary and explanation to clearly indicate which meaning of exposure is intended in each instance, typically by including a qualifier such as “airborne” or “dermal” when a specific type of exposure is involved. Because the intended meaning of the term varies somewhat from instance to instance, the agency finds that adding a definition of “exposure” to the standard may lead to confusion and misunderstanding regarding many provisions of the standard, and maintains that explaining the agency’s meaning in each instance of the term is appropriate. With respect to paragraph (f)(1)(ii)(B), by including no qualifier for the term exposure, OSHA ensures that the provision will be triggered whenever an employee shows signs or symptoms associated with any type of exposure to beryllium.

Paragraph (f)(2) Engineering and work practice controls

Paragraph (f)(2) of this final rule requires employers to use engineering and work practice controls to reduce and maintain employee airborne exposure to beryllium to or below the TWA PEL and STEL, unless they can demonstrate that such controls are not feasible. If an employer demonstrates that it is not feasible to reduce airborne exposure to or below the PELs through engineering and work practice controls, the employer must implement and maintain engineering and work practice controls to reduce airborne exposure to the lowest levels feasible

and supplement these controls by using respiratory protection in accordance with paragraph (g) of this standard.

Paragraph (f)(2) of the 2017 construction and shipyards standards also required the implementation of engineering and work practice controls to limit employee airborne exposure to beryllium. However, in addition to the requirement to implement controls where exposures exceed the TWA PEL or STEL, the 2017 standards required employers to implement at least one engineering or work practice control whenever exposures exceeded the action level. Specifically, paragraph (f)(2)(i) of the 2017 standards required that where exposures are, or can reasonably be expected to be, at or above the action level, employers were to implement at least one of the following control measures to reduce airborne exposure: (1) material and/or process substitution (paragraph (f)(2)(i)(A)); (2) isolation, such as ventilated partial or full enclosures (paragraph (f)(2)(i)(B)); (3) local exhaust ventilation, such as at the points of operation, material handling, and transfer (paragraph (f)(2)(i)(C)); or (4) process control, such as wet methods and automation (paragraph (f)(2)(i)(D)). Paragraph (f)(2)(ii) exempted an employer from this requirement if the employer can establish that the controls are infeasible, or that airborne exposure is below the action level, using no fewer than two representative personal breathing zone samples taken at least seven days apart, for each affected operation. Additionally, if after implementing at least one of the controls required by paragraph (f)(2)(i), airborne exposures still exceeded the PEL or STEL, paragraph (f)(2)(iii) required the employer to implement additional engineering and work practice controls to reduce exposure below these limits. If the employer demonstrated that it is not feasible to reduce exposures below the TWA PEL and STEL through engineering and work practice controls, paragraph (f)(2)(iv) required the employer to implement controls to reduce

exposure to the lowest feasible level and supplement the controls through the use of respirator protection in accordance with paragraph (g) of the standard.

In the 2019 NPRM, OSHA proposed two changes to paragraph (f)(2) of the construction and shipyards standards. First, OSHA proposed to remove the requirement that employers implement engineering and work practice controls at the action level and instead to require such controls only for operations where exposures exceed, or can reasonably be expected to exceed, the PEL or STEL. Second, OSHA proposed to combine the remaining provisions of paragraphs (f)(2)(i) through (iv) into a single paragraph (f)(2).

The requirement to implement controls at or above the action level in the 2017 construction and shipyard standards was derived from the general industry standard, which requires that employers implement at least one type of engineering control for each operation in a beryllium work area that releases airborne beryllium, unless the employer can demonstrate that airborne exposure is below the action level or that the controls are infeasible. In the 2017 final rule, OSHA found that the action level was a “reasonable and administratively convenient benchmark” when attempting to address significant risk below the PELs while not unnecessarily burdening employers where controls would provide little or no benefit (82 FR at 2674). At the same time, the agency recognized that OSHA health standards usually require engineering controls only where exposures exceed the PELs (82 FR at 2673).

In this rulemaking, OSHA has reconsidered this approach to engineering and work practice controls in the construction and shipyards contexts. Because exposure to beryllium in construction and shipyards is almost exclusively limited to abrasive blasting and welding, OSHA preliminarily determined in the 2019 NPRM that requiring engineering controls where exposures are between the action level and the PEL is not reasonably appropriate for these industries.

OSHA reasoned that the technological feasibility analysis for the 2017 final rule showed abrasive blasting with mineral grit typically generates airborne beryllium exceeding the PEL even after implementing engineering controls, thus triggering requirements for respirator use for employees where exposures remain above the PEL (82 FR at 2584). Furthermore, welders in shipyards are already required to use local exhaust ventilation as well as air-line respirators (84 FR at 53910-11). Thus, in the context of abrasive blasting and welding, the previous requirement to implement one engineering control where exposure are between the action level and the PEL will not result in any additional protection to workers. Accordingly, OSHA proposed to require engineering and work practice controls in construction and shipyards only where exposures exceed the TWA PEL or STEL. As acknowledged in the 2017 final rule, this approach is consistent with OSHA's typical approach to health standards (84 FR at 53910).

OSHA received several comments on this proposed change. NABTU stated generally that OSHA should retain the 2017 standards' protections against airborne exposures in paragraph (f)(2) (Document ID 2240, p. 6) and NJH commented that they "agree with OSHA that it is important to retain the requirement to implement engineering and work practice controls to achieve compliance with the PEL and STEL" (Document ID 2211, p. 9). AFL-CIO specifically urged OSHA to retain the requirement to require engineering and work practice controls at the action level, arguing that the construction standard should require the same level of protection as the general industry standard to avoid creating a "two-tiered protection system" (Document ID 2210, p. 7). They argued that not requiring engineering controls at the action level "places any potentially exposed workers between the action level and the PEL at risk . . . by not requiring the hierarchy of controls for these workers"²¹ (Document ID 2210, p. 7). In post-hearing comments,

²¹ The "hierarchy of controls" refers to the policy of requiring employers to install and implement all feasible engineering and work practice controls before relying on respirator use to protect employees (see 82 FR at 2476).

they further argued that “[t]he hierarchy of controls is the most effective way to reduce exposures by controlling releases at the source, rather than near the worker,” as the 2017 final rule required wherever beryllium exposures meet or exceed the action level (Document ID 2244, p. 15).

AFL-CIO additionally cited USW’s comments on the 2015 beryllium NPRM for the proposition that engineering and work practice controls should be required “at the earliest, yet feasible time” (Document ID 2244, p. 15). In the cited comments, USW had argued for requiring engineering or work practice controls for any operation generating airborne beryllium particulate, as USW and Materion had jointly recommended for general industry, noting that such a requirement “is entirely feasible, and would reduce a risk OSHA has shown to be significant” (Document ID 1681, p. 11).

OSHA disagrees with AFL-CIO’s assertion that triggering controls on the PELs will reduce protection for workers in the construction and shipyards industries. As explained in the 2019 NPRM, OSHA’s technological feasibility analysis concluded that workers performing abrasive blasting with mineral grit would typically experience exposures in excess of the TWA PEL even after implementing engineering controls (84 FR at 53910; 82 FR at 2584). Therefore, in the case of abrasive blasting, the requirement to implement at least one engineering or work practice control where exposure meets or exceeds the action level would achieve no further protections than the proposed requirement to implement engineering and work practice controls only when exposure exceeds the PEL. Similarly, in the case of welding, the welding standard for shipyards already requires the use of local exhaust ventilation and air line respirators when welding with beryllium-containing base or filler metals (29 CFR 1915.51(d)(2)(iv)). Therefore, the previous requirement would likewise not provide any further protections for employees

exposed to beryllium through welding; work practice controls are already being used regardless of level of exposure.

As explained above in the Summary and Explanation for paragraph (f)(1), OSHA has determined, based on the record, that beryllium exposures in construction and shipyards are limited almost exclusively to abrasive blasting and a limited number of welding operations in shipyards, and that it is appropriate to tailor certain provisions of the beryllium standards to these operations. Because in these operations the requirement to implement engineering and work practice controls where exposures are between the action level and PEL would provide no additional protection to workers, OSHA has determined it is appropriate to remove this requirement from the construction and shipyards standards.

At the same time, OSHA agrees with AFL-CIO and NJH that reliance on the hierarchy of controls remains important for protecting employees in the construction and shipyards sector. That is why the agency has retained a specific requirement in paragraph (f)(2) for construction and shipyard employers to implement engineering and work practice controls where feasible to achieve compliance with the PEL and STEL, as OSHA has required in other health standards. Where it is not feasible to reduce exposures to or below the PELs, paragraph (f)(2) continues to require employers to implement and maintain engineering and work practice controls to reduce airborne exposure to the lowest levels feasible and supplement these controls by using respiratory protection in accordance with paragraph (g) of the standard. This approach is consistent with OSHA's application of the hierarchy of controls to all other standards applicable to construction and shipyards that require the use of engineering controls to minimize toxic dust. For example, the ventilation standard in construction, 29 CFR 1926.57(f)(2)(ii), requires the

concentration of respirable dust or fume in the breathing zone of the abrasive blasting operator or any other worker to remain below the levels specified in 29 CFR 1926.55.

After reviewing the comments received and the record as a whole, OSHA is finalizing its proposal to revise paragraph (f)(2) to remove the requirement that employers implement engineering and work practice controls wherever exposures are between the action level and PEL. OSHA received no comments on its additional proposal to combine the remaining provisions of paragraphs (f)(2)(i) through (iv) into a single paragraph (f)(2) and is therefore finalizing paragraph (f)(2) as proposed.

Paragraph (g) Respiratory Protection

Paragraph (g) of this final rule requires the provision and use of respiratory protection under several conditions to protect against exposure to beryllium. Paragraph (g)(1) requires employers to provide respiratory protection at no cost to employees and to ensure that employees utilize such protection in the following circumstances: (i) during periods necessary to install or implement feasible engineering and work practice controls where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL (paragraph (g)(1)(i)); (ii) during operations, including maintenance and repair activities and non-routine tasks, when engineering and work practice controls are not feasible and airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL (paragraph (g)(1)(ii)); (iii) during operations for which an employer has implemented all feasible engineering and work practice controls when such controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL (paragraph (g)(1)(iii)); and (iv) when an employee who is eligible for medical removal under the standard chooses to remain in a job with airborne exposure at or above the action level (paragraph (g)(1)(iv)).

This final rule includes one change from paragraph (g)(1) as promulgated in the 2017 final rule. In the NPRM, OSHA proposed removing previous paragraph (g)(1)(iv), which required the use of respiratory protection during emergencies, from both the construction and shipyards standards.²² As explained previously in this preamble in the summary and explanation for paragraph (b), OSHA also proposed removing the definition of “emergency”—defined as “any uncontrolled release of airborne beryllium”—from both standards. OSHA reasoned that any uncontrolled release of airborne beryllium in these industries, such as from the failure of blasting control equipment or a spill of abrasive blasting media, would only occur during the performance of routine tasks—i.e., abrasive blasting and welding—that are already associated with the airborne release of beryllium (84 FR at 53911). During these processes, OSHA anticipates that employees working in the immediate vicinity of an uncontrolled release of airborne beryllium would already be using respiratory protection pursuant to the other provisions in paragraph (g)(1).

Three commenters addressed OSHA’s proposal to strike paragraph (g)(1)(iv). In both their pre-hearing comments and at the public hearing, the AFL-CIO argued that OSHA “makes the faulty assumption” that all types of worksites and emergencies—i.e., fires, floods, chemical releases—will create the same conditions and warrant the same type of response to beryllium exposure (Document ID 2210, Comments, p. 5; Tr., Document ID 2222, p. 119). They further commented that although workers with the highest beryllium exposures (i.e., abrasive blasters) may use full protective equipment, other workers that do not typically wear such equipment might be exposed in the case of an emergency or even during normal working conditions (Document ID 2210, Comments, p. 5). Finally, they argued that it is important to tailor

²² As a result, OSHA also proposed to renumber paragraph (g)(1)(v) as (g)(1)(iv) in both standards.

emergency procedures to the specific type of work environment (Document ID 2210, Comments, p. 5).

North America's Building Trade Unions (NABTU) likewise commented that breaches in abrasive blasting containments could expose workers to beryllium who are not otherwise typically exposed (Tr., Document ID 2222, pp. 86, 91-92; Document ID 2240, pp. 7-8). NABTU conceded that, with respect to abrasive blasters and welders, the only type of emergency it could envision was a breach in the abrasive blasting containment (Tr., Document ID 2222, pp. 102-03). However, in their post-hearing brief, NABTU argued that OSHA's proposal ignores workers who perform shut-down maintenance, decontamination, and clean-up work in beryllium processing facilities (Document ID 2240, pp. 7-8). The union cited records from a primary beryllium facility indicating that the facility had experienced leaks, spills, and evacuations due to events such as fires, which could result in the unexpected release of beryllium. NABTU argued that the removal of emergency provisions in the construction standard would result in different protective measures being applied for general industry and construction employees in these facilities. Finally, NABTU urged the importance of including exposures from emergencies in medical and work histories "to ensure that pertinent information about potential exposures is not overlooked."

NJH agreed with OSHA that abrasive blasting and welding operations may not result in emergencies (Document ID 2211, p. 6). However, NJH further stated that, because the uncontrolled release of beryllium can occur at any time during operations such as abrasive blasting, "all workers should be put in respirators and they should be cleaned and maintained as detailed in the beryllium standard for general industry" (Document ID 2211, p. 9). NJH also commented that, although they agree the term "emergency" can be struck from the standards,

any exposure above the PEL should trigger medical surveillance that was previously provided after an emergency—that is, without regard to the requirement in paragraph (k)(1)(i)(B) that employees be exposed above the action level for more than 30 days per year (Document ID 2211, p. 6-7; Tr., Document ID 2222, pp. 56-7).

After considering these comments and the record as a whole, OSHA is finalizing its proposal to eliminate the emergency provision from paragraph (g). With respect to some commenters' concerns that OSHA is overlooking workers or operations outside of abrasive blasters and welders, the agency makes several observations. First, paragraph (g)(1)(ii) requires employees engaged in maintenance, repair activities, and non-routine tasks to wear respiratory protection when engineering and work practice controls are not feasible and airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL. This provision would apply in scenarios such as breached containments or spills that create a risk of airborne exposure. Moreover, paragraph (g)(1)(iii) requires respirator use during operations where feasible engineering and work practice controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL. As OSHA has previously noted, any employees who are not abrasive blasters or welders but who are in the vicinity of such operations—such as pot tenders or cleanup workers—are already required to wear respiratory protection because of their proximity to operations known to create airborne beryllium exposures above the TWA PEL or STEL (see 84 FR at 53920).²³

Second, as with other areas of the proposal, the commenters suggest that OSHA is ignoring construction and shipyards workers in operations outside of abrasive blasting and

²³ In the 2017 Final Rule, OSHA found that pot tender and cleanup work are usually remote from the abrasive blasting operation or occur prior to or after the operation is complete (82 FR at 2686-87). As such, OSHA notes that only a subset of these workers (those performing their tasks during and adjacent to the abrasive blasting operation) would potentially be exposed during an event such as a containment rupture.

welding who may be exposed to beryllium. The commenters primarily point to workers who perform construction work at general industry sites that process beryllium and workers who dress non-sparking tools (see, e.g., Document ID 2210, Comments, pp. 4-5; 2240, pp. 7-8). As explained previously in this preamble, OSHA repeatedly requested information and data on application groups outside of abrasive blasting and welding, but no commenters have provided data sufficient for OSHA to draw any conclusions about exposures in these contexts. For the same reason, OSHA lacks any information on potential exposures from “unexpected releases of a chemical, fires, [or] floods” in these contexts (see AFL-CIO, Document ID 2210, Comments, p. 5). For the reasons already stated, OSHA had determined that, given this lack of data, it is appropriate to tailor the construction and shipyards beryllium standards to those operations for which the agency has sufficient data to demonstrate worker exposure to beryllium at levels of concern, to properly characterize and evaluate the exposures, and to develop appropriate measures to address them. Moreover, as discussed previously, OSHA expects that beryllium exposures during processes outside of abrasive blasting and welding, if they occur, are rare. Given the rarity of these exposures during normal processes, the agency expects that emergency exposures in these contexts would be exceedingly rare, to the point of not being reasonably foreseeable. For a full discussion of OSHA’s reasoning on these points, see the summary and explanation of paragraph (f)(1).

In the operations for which OSHA does have sufficient data (i.e., abrasive blasting and welding operations), the agency has determined that it is unnecessary to trigger respiratory protection requirements on the occurrence of an emergency. As OSHA noted in the NPRM, and as at least one commenter agreed (Document ID 2211, p. 6), any uncontrolled release of beryllium in these operations will not create exposures that differ from the normal conditions of

work and workers should already be protected by the other provisions of paragraph (g).

Accordingly, OSHA is finalizing its proposal to remove paragraph (g)(1)(iv) from the beryllium standards for construction and shipyards.²⁴

Paragraph (h) Personal Protective Clothing and Equipment

Paragraph (h) of the beryllium standards for the construction and shipyards industries (29 CFR 1926.1124(h) and 1915.1024(h), respectively) provides requirements relating to personal protective clothing and equipment (PPE). Paragraph (h)(1) requires employers to provide and ensure the use of PPE in accordance with the written exposure control plan required under paragraph (f)(1) of this standard and OSHA's Personal Protective and Life Saving Equipment standards for construction (29 CFR part 1926, subpart E) where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL. Employers are expected to choose the appropriate type of PPE for their employees based on the results of the employer's hazard assessment (82 FR at 2682), and the employer must list in the written exposure control plan the PPE that is required under paragraph (h)(1) (see paragraph (f)(1)(i)(C)). Paragraph (h)(2) governs the removal of PPE,²⁵ and requires employers to ensure that each employee removes PPE required by this standard at the end of the work shift or at the completion of all tasks involving beryllium, whichever comes first, and that PPE is not removed in a manner that disperses beryllium into the air. Additionally, under the PPE cleaning and replacement

²⁴ As to NJH's suggestion that, in light of the removal of emergency triggers in the standards, OSHA should amend paragraph (k) to require medical surveillance for any exposure above the action level or PEL, rather than for those exposed over the action level for 30 days, OSHA addresses this in the summary and explanation of paragraph (k). Likewise, with respect to NABTU's comment that exposures during emergencies should be included in employees' medical and work histories, OSHA addresses this comment in the summary and explanation for paragraph (k)(4). Finally, NJH's comment that all respirators should be cleaned as required in general industry is addressed in the summary and explanation of paragraphs (h).

²⁵ Paragraph (h)(2) of the construction and shipyards beryllium standards was titled "Removal and storage." As explained below, OSHA is removing the provisions in paragraph (h)(2) that pertain to the storage of PPE. Accordingly, OSHA has revised the title of paragraph (h)(2) to read "Removal of PPE."

provisions in paragraph (h)(3), employers must ensure that all reusable PPE required by the standard is cleaned, laundered, repaired, and replaced as needed to maintain its effectiveness, and that beryllium is not removed from PPE by blowing, shaking or any other means that disperses beryllium into the air.

This rule finalizes the proposed changes to paragraph (h) in the 2019 NPRM, including OSHA's proposal to remove the requirement, formerly designated paragraph (h)(1)(ii), to provide and ensure the use of PPE when there is reasonably expected dermal contact with beryllium (see 84 FR at 53913). As explained in the NPRM, OSHA did not intend for the standards' provisions aimed at protecting workers from the effects of dermal contact with beryllium to apply to operations that involve materials containing only trace amounts of beryllium absent significant airborne exposures (84 FR at 53912 (citing 83 FR at 19938); see also 84 FR at 53905-06). In the construction and shipyards sectors, the operations that cause airborne exposure to beryllium that can exceed the TWA PEL or STEL are either abrasive blasting operations, which involve materials or generate particulate matter containing less than 0.1 percent beryllium by weight, or welding operations in shipyards, where the process and materials do not present a dermal contact risk. OSHA thus proposed to remove the requirement to provide and ensure the use of PPE when there is reasonably expected dermal contact with beryllium because it was not aware of any operations in the construction or shipyard sectors in which dermal contact with beryllium would occur at levels above trace amounts, making such a provision unnecessary.

OSHA received comments challenging the underlying premise that abrasive blasting operations and welding operations in shipyards would not result in dermal contact with beryllium at levels above trace amounts. Specifically, NJH, citing a study indicating that beryllium was

“present at a concentration of 4 parts per million (ppm) in coal slag samples analyzed prior to blasting, and measured airborne beryllium concentrations of up to 9.5 µg/m³ during abrasive blasting tasks,” questioned OSHA’s determination that abrasive blasting operations only contain or produce materials containing trace concentrations of beryllium (Document ID 2211, p. 7). Additionally, USW contested OSHA’s statement that skin or surface contamination is not likely to result from welding operations in shipyards, stating that “beryllium-copper rods typically contain 2 percent beryllium and at least one manufacturer warns users against grinding, cutting or polishing the weld without proper protection,” and alleging that “welds are often subjected to the operations the manufacturer warned against, sometimes by workers other than welders” (Document ID 2212, p. 3; see also Document ID 2222, Tr. 31 (USW stating that it believes that welding rods containing up to 2 percent are sometimes used, but USW does not know how often)). In support, USW pointed to an information sheet on beryllium copper welding wire and rods published by U.S. Alloy Company (Document ID 2212, Attachment A).

OSHA responded to these comments in the summary and explanation section for paragraph (f). In short, NJH’s concern is misplaced because the 4 ppm of beryllium documented in the coal slag samples in the study that NJH cited, which would amount to 0.0004 percent by weight, is a trace amount within OSHA’s usage of that term (0.1 percent beryllium by weight or less). So too is USW’s concern about skin contamination during welding operation. As OSHA explained in the NPRM, the agency’s understanding that the amount of beryllium oxide to form on the surface of materials being welded in shipyards is likely far lower than would be expected based solely on the percentage of beryllium in the base metal is based on a study by Cole, 2007 (84 FR at 53906; see Document ID 0885, p. 685). USW’s comment does not discuss this study, nor does it offer evidence to undermine the conclusions that OSHA has drawn from it (see

above, Summary and Explanation for paragraph (f)(1)). The information sheet from U.S. Alloy Company that USW included with its comment makes no mention of a dermal contact risk from the welding rods used in the operation, and instead warns that action “should be taken to avoid inhaling the welding fumes” (Document 2212, Attachment A). OSHA finds that the lack of any mention of a risk of dermal contact with beryllium in the information sheet supports OSHA’s determination that dermal exposures are not a concern in welding operations.

OSHA also received several comments expressing concern that, by removing from the standards the provisions that are solely aimed at preventing dermal contact with beryllium (including paragraph (h)(1)(ii)), OSHA would expose workers to a significant risk of harm, and would be abandoning its position in the 2017 final rule that all construction and shipyard industry employees within the scope of the standards need protection against dermal contact with beryllium (Document ID 2210, p. 4, 7; 2212, p. 4; 2239, p. 1; 2240, p. 5; 2244, pp. 8-10; see also Document ID 2222, Tr. 117-18). Relatedly, commenters expressed concern that OSHA’s proposed revisions would not sufficiently protect workers who may be exposed to dermal contact with dust, fumes, or mists containing beryllium in greater-than-trace concentrations in operations other than abrasive blasting and welding, such as maintenance, renovation, repair and demolition operations at locations where beryllium operations were performed; maintenance of non-sparking tools; or, in new operations that construction and shipyards employers may undertake in the future (Document ID 2202, p. 2; 2208, pp. 6-7; 2210, pp. 4-5, 7; 2211, pp. 1, 7-8, 10; 2212, pp. 2-4; 2213, pp. 3-4; 2239, pp. 1-2; 2240, pp. 3-5; 2242, pp. 2-3; 2244, p. 13; see also Document ID 2222, Tr. 17-19, 32, 47-48, 84-87, 114-15, 131).

OSHA also fully responded to these comments in the Summary and Explanation for paragraph (f). In short, OSHA has not changed its position on the employees who require

protection from dermal contact with beryllium in the construction and shipyards sectors, nor has it changed its position that all employers with operations that fall within the scope of the standards must comply with their terms. OSHA has not changed (or proposed to change) the scope of the standards, which are broadly drawn to cover all occupational exposure to beryllium in all forms, compounds, and mixtures in construction, except those articles and materials specifically exempted. The standards continue to require employers to apply provisions related to dermal contact, through the provision of PPE and other measures, when airborne exposures exceed the TWA PEL or STEL. OSHA's removal of the provisions solely aimed at preventing dermal contact with beryllium without airborne exposures furthers the agency's intent to tailor the construction and shipyards beryllium standards to the specific operations on which it has data documenting significant exposures of concern (i.e., abrasive blasting operations and welding operations in shipyards).

When the agency applied some of the ancillary provisions that it developed for general industry employers into the construction and shipyards standards in the 2017 final rule (such as the provisions triggered on dermal contact with beryllium or beryllium contamination), OSHA did not fully account for the trace levels of beryllium involved in construction and shipyards operations. As OSHA clarified in the 2018 general industry DFR (83 FR at 19938-39), OSHA only intended the provisions triggered by dermal contact with beryllium or beryllium contamination to apply to dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight. The agency did not intend to regulate contact with trace beryllium absent significant airborne exposures. Given that abrasive blasting operations do not involve materials containing beryllium in more than trace concentrations, and the welding operations in shipyards that create airborne exposures of concerns do not pose a risk of skin

contamination, OSHA recognized in the 2019 NPRM that the provisions in the construction and shipyards beryllium standards triggered on dermal contact with beryllium or beryllium contamination (such as paragraph (h)(i)(ii)) would never be triggered (see, e.g., 84 FR at 53906, 53913).²⁶

The comments received in response to the NPRM have not convinced OSHA otherwise. Although OSHA continues to recognize the possibility that some construction and shipyards workers could be exposed to beryllium through activities other than abrasive blasting and welding, the record still lacks key data about these potential additional sources of exposure, including how often they occur, who is exposed, the duration of the exposures, the type and extent of exposure, or any controls that may be in place to address them. Specifically, as discussed below, OSHA finds that the record lacks evidence that exposures in any construction or shipyards operation would involve a risk of dermal contact with beryllium in greater-than-trace amounts.

As explained more fully in the Summary and Explanation for paragraph (f), a number of commenters responded to OSHA's request for information on any additional application groups (industries, occupations, processes, etc.) with potential exposure to beryllium in the construction and shipyards sectors beyond abrasive blasting and welding operations (see 84 FR at 53922; Document ID 2222, Tr. 33-35; 44-45; 75-76; 95-96; 125-26), but their comments in many cases relied on anecdotal or unverifiable assertions about additional exposure sources. Some

²⁶ OSHA notes that the term "beryllium contamination" is not defined in the construction and shipyards standards. In the DFR for general industry, to clarify OSHA's intent that the standard's requirements aimed at reducing the effect of dermal contact with beryllium should not apply to areas where there are no processes or operations involving materials containing at least 0.1% beryllium by weight, the DFR defined "beryllium-contaminated or contaminated with beryllium" and added those terms to certain provisions in the standard. The DFR defined those terms as follows: "Contaminated with beryllium and beryllium-contaminated mean contaminated with dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight" (83 FR at 19939).

commenters submitted studies regarding operations that, in the commenter's view, could expose employees to greater-than-trace concentrations of beryllium at general industry facilities.²⁷ But the studies do not contain relevant exposure data, nor do they reflect the conditions that employees are likely to encounter at general industry workplaces today. Although some commenters alleged that construction and shipyards workers could be exposed to beryllium in greater-than-trace concentrations during the dressing or sharpening of beryllium-containing non-sparking tools, other comments and hearing testimony more persuasively indicated that the dressing or sharpening of non-sparking tools is not an exposure source of concern for workers in the construction and shipyards sectors covered by the beryllium standards. For example, at the public hearing, a representative from NABTU, indicated that although non-sparking tools are used in the petrochemical industry, NABTU could not find examples of tradespeople dressing and sharpening the tools (Document ID 2222, Tr. 88). Indeed, Materion commented that at least one supplier of beryllium containing non-sparking tools offers tool sharpening as a free service to its customers (Document ID 2237, p. 3).

Accordingly, OSHA is tailoring certain aspects of the final construction and shipyards beryllium standards to the operations for which the agency has sufficient data to demonstrate worker exposure to beryllium at levels of concern, to properly characterize and evaluate the exposures, and to develop appropriate measures to address them (i.e., abrasive blasting operations and limited welding operations in shipyards). Tailoring the construction and shipyards beryllium standards to these operations ensures that the standards are no more complex or

²⁷ OSHA also asked AFL-CIO and NABTU at the hearing whether workers needed to be protected against dermal contact with only trace concentrations of beryllium (see Document ID 2222, Tr. 94-95, 121-22). As Materion and CISC pointed out in their post-hearing submissions (Document IDs 2237, p. 1; 2241, p. 8), neither party directly responded to OSHA's question.

onerous than is needed to protect workers, which OSHA believes will improve compliance and thereby better protect workers.

Removing the provisions triggered on dermal contact with beryllium (such as former paragraph (h)(1)(ii)) reflects OSHA's intent to regulate contact with trace beryllium only when it causes airborne exposures of concern. OSHA acknowledged in the 2017 final rule that there is "potential for exposure" in operations other than abrasive blasting and welding (and fashioned the scope of the standards accordingly), but never determined that workers in the construction industry are currently at risk of dermal contact with greater-than-trace amounts of beryllium when working at general industry worksites, or when dressing or sharpening non-sparking tools. Where OSHA did originally include provisions aimed solely at dermal contact in the construction and shipyards standards that it now intends to remove, including paragraph (h)(i)(ii), it was due to the agency borrowing provisions from the general industry standard without appropriately accounting for the trace exposures in abrasive blasting and welding as they pertain to dermal contact. Inclusion of these provisions was not based on a finding by OSHA that the provisions were necessary to address exposures beyond abrasive blasting and welding. OSHA finds that the standards as revised will maintain protections in all likely exposure scenarios while more appropriately addressing the operations from which exposures regularly occur.

Multiple commenters also expressed concern that OSHA's proposed removal of the provisions that target dermal contact with beryllium would result in insufficient protection for employees who work near, or in support of, abrasive blasting operations, such as pot tenders and clean-up helpers (see Document ID 2210, p. 4; 2211, p. 8; 2239, p. 3). Particularly, AFL-CIO commented that previously-submitted evidence in the record indicates that "bystander" workers

are not typically protected against exposure to beryllium to the same extent as workers directly involved in abrasive blasting operations, and claimed that OSHA has “proposed to revoke protections that would protect against an increased risk of cumulative inhalation and skin exposures even when there are significant airborne exposures, especially among those working near operations with significant airborne exposures” (Document ID 2210, p. 4 (citing Document IDs 2118, 2129, and 2135); see also Document ID 2222, Tr. 117-18, 122-23). AFL-CIO also claimed that “[r]espirators and other PPE do nothing to address bystander exposure and leave wide variability in the times they are worn” (Document ID 2239, p. 3). USW also commented at the hearing that “even though the blasters, the people who were actually engaged in an operation may be well protected, there may be bystanders who may be exposed to things that escape from containment or that are left over after the containment’s removed” (Document ID 2222, Tr. 45).

OSHA has always intended for the construction and shipyards beryllium standards to protect workers who support, or are bystanders to, abrasive blasting operations, and OSHA’s beryllium standards protect such workers through various mechanisms, including the requirement for such workers to wear PPE when they have reasonably expected airborne exposure to beryllium. When the agency promulgated the standards in 2017, OSHA concluded that “pot tenders/helpers, and cleanup workers have the potential for significant airborne beryllium exposure during abrasive blasting operations and during cleanup of spent abrasive material” and thus “require protection under the beryllium standards” (82 FR at 2638).

Additionally, OSHA determined in the 2019 final rule that, despite partial overlap between the requirements of the beryllium standards and other existing OSHA standards, OSHA could not revoke paragraph (h) in its entirety because “[s]ome workers exposed to beryllium in construction and shipyards, such as abrasive blasting helpers, would not be fully protected if

OSHA revoked the requirements for PPE in their entirety.” 84 FR 51394. OSHA has not wavered from its position that abrasive blasting support and bystander workers must be protected against potential airborne exposure to beryllium.

Paragraph (h)(1) requires employers to provide and to ensure the use of PPE for abrasive blasting support workers and other bystanders when those employees are reasonably expected to have airborne exposure to beryllium at levels above the TWA PEL or STEL. Whether or not such workers have tended to wear PPE with the same consistency as abrasive blasting operators, these standards expressly require such workers to use appropriate PPE whenever they have reasonable expected airborne exposure to beryllium above the TWA PEL or STEL. This protects abrasive blasting support workers and bystanders from the incremental additional beryllium load caused by re-entrainment of trace beryllium where there is already significant airborne exposure, while maintaining OSHA’s intent that dermal contact with trace beryllium alone did not require protections (84 FR at 53912 (citing 83 FR at 19938); see also 84 FR at 53905-06).

As further discussed below, and in the Summary and Explanation for paragraph (f), such workers are also protected from exposure to airborne beryllium by several other provisions, including the PPE removal and cleaning provisions, the requirements to include certain procedures in the written exposure control plan (paragraph (f)(1)), and the housekeeping requirements in paragraph (j). AFL-CIO is thus incorrect that the revised beryllium standards do not protect abrasive blasting support workers and bystanders when there are significant airborne exposures.

This rule also finalizes OSHA’s proposed modifications to paragraphs (h)(2) and (3) of the standards, with two exceptions in paragraph (h)(2). In the NPRM, OSHA proposed to revise the language of several provisions in paragraphs (h)(2) and (3) (see 84 FR at 53913-14). First,

OSHA proposed to revise paragraph (h)(2)(i) so that it requires each employee to remove PPE required by the standards at the end of the work shift or, at the completion of all tasks involving beryllium, whichever comes first. To do this, OSHA proposed to remove the qualifier indicating that workers should remove “beryllium contaminated” PPE, and instead add language indicating that workers should remove PPE “required by this standard.” OSHA also proposed removing the phrase requiring PPE to be removed when it becomes “visibly contaminated with beryllium.” OSHA considers a surface to be contaminated with beryllium when it has been contaminated with dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight, and OSHA explained that removing the “beryllium contaminated” and “visibly contaminated with beryllium” language reflects the agency’s understanding that the data-supported operations that create exposures at levels of concern in these industries (abrasive blasting and some welding in shipyards) will not create a beryllium-contaminated surface.

OSHA explained in the NPRM, however, that where employees working with materials containing trace concentrations of beryllium nonetheless have the potential for airborne exposure above the TWA PEL or STEL, and would thus still be required to use PPE under paragraph (h)(1), they would likely be working in highly dusty environments that could accumulate large amounts of dust on their PPE (84 FR at 53913). In those situations, the proposed paragraph (h)(2)(i) would require employees to remove their PPE at the end of the work shift or when all tasks involving beryllium have completed, whichever comes first to prevent the dust on the PPE from being re-entrained into the air and contributing to the airborne exposure of workers who already are, or can reasonably be expected to be, exposed above the TWA PEL or STEL.

For the same reason, OSHA also proposed in the NPRM to replace the qualifier in paragraph (h)(2)(ii) that PPE be “beryllium contaminated,” and instead add language clarifying

that the provision applies to PPE “required by the standard.” The resulting proposed paragraph (h)(2)(ii) would require employers to ensure that PPE required by the standard is not removed in a manner that disperses beryllium into the air, which can be accomplished by cleaning the PPE prior to removal or carefully removing the PPE so as not to disturb the dust.

OSHA also proposed to remove the language from paragraph (h)(2)(ii) requiring employers to ensure that employees remove PPE in accordance with the written exposure control plan to reflect OSHA’s simultaneous proposal to remove from paragraph (f) the requirement to include procedures for doffing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated PPE in the written exposure control plan. However, as discussed in the Summary and Explanation for paragraph (f), OSHA has determined that written exposure control plans should continue to include procedures for those PPE requirements that OSHA did not propose to remove. Accordingly, OSHA is including in paragraph (f) a requirement that the written exposure control plan include procedures for removal, cleaning, and maintenance of PPE in accordance with paragraph (h) (see paragraph (f)(1)(i)(F)). Having retained these procedures in the written exposure control plan, OSHA is not finalizing its proposal to remove the reference to the written exposure control plan from paragraph (h)(2)(ii).

For paragraph (h)(3), OSHA also proposed to add language to clarify that the requirement that employers ensure that beryllium is not removed from PPE by blowing, shaking or any other means that disperses beryllium into the air applies to PPE that is “required by the standard.” OSHA explained in the NPRM that the proposed revision would assure employers that, if dust containing only trace amounts of beryllium migrates to the PPE of employees who are not reasonably expected to have airborne exposure to beryllium above the TWA PEL or STEL, the beryllium standards permit that PPE to be removed and cleaned in a manner that disperses that

dust into the air. The proposed revision is thus consistent with the agency's goal of protecting employees who already have reasonably expected airborne exposure to beryllium at levels of concern from inhaling re-entrained beryllium-containing dust.

In addition to these proposed revisions to paragraphs (h)(2) and (3), OSHA proposed to remove four provisions from paragraphs (h)(2) and (3): the requirement to ensure that each employee stores and keeps beryllium-contaminated PPE separate from street clothing and that storage facilities prevent cross-contamination as specified in the written exposure control plan (paragraph (h)(2)(iii)); to ensure that beryllium-contaminated PPE is only removed from the workplace by employees who are authorized to do so for the purpose of laundering, cleaning, maintaining, or disposing of such PPE (paragraph (h)(2)(iv)); to ensure that PPE removed from the workplace for laundering, cleaning, maintenance, or disposal be placed in closed, impermeable bags or containers labeled in accordance with the standards' employee information and training requirements and the Hazard Communication standard (paragraph (h)(2)(v)); and, to inform, in writing, any person or business entity who launders, cleans, or repairs PPE required by the standards of the potentially harmful effects of exposure to airborne beryllium and dermal contact with beryllium, and of the need to handle the PPE in accordance with the standards (paragraph (h)(3)(iii)). OSHA proposed to remove paragraphs (h)(2)(iii) and (iv), which apply only to "beryllium-contaminated" PPE, because, as explained above, OSHA has defined "beryllium-contaminated" as contaminated with dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight (see 83 FR at 19939), and the data-supported operations that produce beryllium exposures of concern in the construction and shipyards industries (abrasive blasting and some welding in shipyards) will not produce such "beryllium-contaminated" PPE. As for the requirements in paragraphs (h)(2)(v)

and (h)(3)(iii), which were included to protect individuals who handle beryllium-contaminated items after operations involving beryllium have been completed (82 FR at 2683), OSHA preliminarily determined in the NPRM that it is unnecessary to protect such downstream handlers of PPE in this context. Given the operations to which these standards are tailored, downstream handlers of PPE could only come in contact with dust that contains beryllium in trace concentrations, and OSHA has no reason to believe that those individuals would be engaging in tasks that could generate airborne exposures at levels of concern. In keeping with OSHA's intent to only regulate contact with trace concentrations of beryllium when workers are exposed to significant airborne exposure to beryllium, OSHA proposed that these two provisions targeting downstream handlers of PPE are unnecessary and should be removed.

OSHA received only a few comments that specifically addressed the proposed changes to paragraphs (h)(2) and (h)(3). NJH stated that “[t]he same protections should be in place for shipyards and constructions as in general industry when using, handling, cleaning and repairing PPE” (Document ID 2211, p. 10). Additionally, when commenting on OSHA's proposed revisions to paragraph (f), NJH stated that, when workers clean and dismantle containments, “clothes and PPE for non-blasting workers are likely to be contaminated with beryllium particulate and need to be removed, laundered, stored, cleaned, repaired, and disposed of in a manner similar to that outlined in the original housekeeping provision” (Document ID 2211, p. 8). NJH also argued that the written exposure control plan should include procedures to identify and minimize beryllium exposures to workers involved in cleaning and maintaining PPE, and that whenever beryllium exposures are generated during a process, PPE used during the process should be handled in the manner outlined in the 2017 final rule (Document ID 2211, p. 9).

OSHA does not agree that it is necessary or appropriate for the construction and shipyards beryllium standards to contain the exact same PPE handling requirements as the general industry beryllium standard. As explained above, OSHA finds it appropriate to tailor the construction and shipyards beryllium standards to the limited operations in those sectors for which OSHA has significant evidence of exposures to beryllium at levels of concern (abrasive blasting operations and some welding operations in shipyards). Those operations do not create a risk of dermal contact with dust, fumes, or mists containing greater-than trace concentrations of beryllium, and therefore PPE used during such operations will not accumulate surface dust with greater-than-trace concentrations of beryllium. OSHA agrees, however, that it is beneficial and necessary to require employers to establish and describe procedures for removing, cleaning, and maintaining PPE in the written exposure control plan. As discussed in the Summary and Explanation for paragraph (f), OSHA has included such a requirement in paragraph (f)(1)(i)(F) of the standards, and as noted above, has retained the requirement in paragraph (h)(2)(ii) that PPE be removed as specified in the written exposure control plan.

AFL-CIO commented that the proposed modifications to paragraph (h)(2) and (3), when combined with OSHA's proposed changes to paragraph (f), "increase the cumulative exposure risk for workers wearing" PPE and "the risk of cross-contamination and migration of beryllium exposing workers with no respiratory or dermal protection" (Document ID 2210, p. 7). Particularly, AFL-CIO expressed concern that OSHA's proposed requirement for written exposure control plans to include procedures used to ensure the integrity of each containment used to minimize exposures to employees outside of containments used to limit bystander exposures (paragraph (f)(1)(i)(E) of the construction standard and paragraph (f)(1)(i)(D) of the shipyards standard) "would create a higher concentration of beryllium dust inside the enclosure,"

while OSHA's proposed revisions to paragraphs (f) and (h)(2) and (3) would no longer require employers to use specific procedures to ensure that PPE is safely doffed (Document ID 2210, p. 7).

AFL-CIO also expressed concern that OSHA's proposed modifications to paragraphs (h)(2) and (3) would not sufficiently protect downstream handlers of PPE. AFL-CIO stated that, "by removing provisions to keep contaminated PPE separate and labelled, as well as, informing those who will come into contact with the PPE that there is potential of beryllium exposure," OSHA has "assume[d] without evidence that downstream handlers of PPE will not generate airborne exposures," which leaves "other employers at risk of exposing their employees to a carcinogen without their knowledge" (Document ID 2210, pp. 8, 10). AFL-CIO similarly stated at the hearing that "there's no evidence in the record that shows that [downstream] workers will not generate airborne exposure and that they should not be informed about the hazards of beryllium" (Document ID 2222, Tr. 118-19).

In its post-hearing brief, AFL-CIO further discussed its belief that preventing cross-contamination and migration of beryllium-containing dust is essential to protecting workers (see Document ID 2244, pp. 10-15), and cite a 2019 NIOSH publication of a study by Virji et al. that stressed the importance of minimizing dust migration to reduce the risk of beryllium sensitization (Document ID 2244, pp. 11-12 (citing Document ID 2239)). AFL-CIO specifically expressed concern that "[a]brasives blasting, a high dust producing task, is likely to result in significant dust migration and cross-contamination leading to increased beryllium inhalation and dermal exposure if the provisions in the [2017] final rule do not remain in place" (Document ID 2244, p. 12).

Although specifically directed in response to OSHA's proposed revisions to paragraph (f), NABTU also expressed its belief that OSHA must retain the standards' procedures for minimizing cross-contamination and migration of beryllium-containing dust (Document ID 2240, p. 5). NABTU likewise pointed to the Virji et al. study, stating that the study indicated "that workers at a primary beryllium producing facility who were not directly involved in beryllium-related operations were still exposed to beryllium in sufficient quantities to cause beryllium sensitization," and therefore provides "further support to the need to ensure workers handle their clothing and other personal protective equipment in ways that minimize the potential that either they, their family members or others who may handle the PPE are incidentally exposed" (Document ID 2240, p. 6).

OSHA disagrees with AFL-CIO and NABTU. The modifications to paragraphs (h)(2) and (3), when combined with the modifications to paragraph (f)(1), maintain the necessary protections for workers. As explained above, the activities to which the construction and shipyards standards are tailored (abrasive blasting operations and limited welding operations in shipyards) do not present a risk of dermal contact with beryllium in greater-than-trace concentrations. In this context, the purpose of the provisions of paragraphs (h)(2) and (3) is to prevent workers with significant airborne exposure to beryllium from the additional inhalation risk that could result if beryllium-containing dust were to spread and become re-entrained in the air.

OSHA finds that paragraphs (h)(2) and (3) have been appropriately revised to achieve this purpose. The revised paragraph (h)(2)(i) requires that employees who have reasonably expected airborne exposure to beryllium at levels above the TWA PEL or STEL remove their PPE at the end of the work shift or all tasks involving beryllium, and revised paragraphs

(h)(2)(ii) and (h)(3)(ii) prohibit removing PPE, or beryllium from PPE, in a manner that would disperse beryllium into the air. These requirements are supplemented by the requirement in paragraph (f)(1)(i)(F) for employers to include procedures for removing, cleaning, and maintaining PPE in the written exposure control plan, and work in concert with additional provisions that minimize the potential for beryllium-containing dust to spread in the workplace. Specifically, that goal is furthered by the standards' requirements to restrict access to work areas at construction worksites where exposures to beryllium could reasonably be expected to exceed the TWA PEL or STEL (paragraphs (f)(1)(i)(D) and (e)(2)) and establish and limit access to regulated areas at shipyard worksites (paragraph (e)); establish procedures to ensure the integrity of containments (paragraphs (f)(1)(i)(E) in construction and (f)(1)(i)(D) in shipyards);²⁸ establish engineering and work practice controls (paragraph (f)(2)); and, engage in housekeeping practices that limit the potential for airborne exposure to beryllium (paragraph (j)).

To further prevent beryllium-containing dust from creating an additional inhalation risk to employees who already have the potential for airborne exposure above the TWA PEL or STEL, OSHA has decided against finalizing its proposal to remove former paragraph (h)(2)(iv) from the standards, and has retained a revised version of that requirement in the standards. As discussed above, paragraph (h)(2)(iv) previously required the employer to ensure that no employee removes beryllium-contaminated PPE from the workplace, except for employees authorized to do so for the purposes of laundering, cleaning, maintaining or disposing of

²⁸ AFL-CIO's concern that these containment integrity provisions in paragraph (f) will increase the levels of exposure for employees who are required to wear PPE under the beryllium standards is mistaken. As discussed in the Summary and Explanation for paragraph (f), these new provisions do not require employers to use containments, but rather require that, when an employer chooses to use a containment (such as a tarp or other structure), the employer must include in its written exposure control plan specific procedures for ensuring the integrity of the containment. The purpose of the paragraphs is to ensure that, when an employer chooses to use a containment, it is used in such a way that employees outside of the containment are not inadvertently exposed to beryllium at levels above the TWA PEL or STEL. Contrary to AFL-CIO's suggestion, adding these paragraphs to the standards will merely ensure that containments, when used, accomplish their intended function.

beryllium-contaminated PPE at an appropriate location or facility away from the workplace. OSHA proposed to remove this provision because the data-supported operations that produce beryllium exposures of concern in the construction and shipyards industries (abrasive blasting and some welding in shipyards) will not produce “beryllium-contaminated” PPE as OSHA has defined that term (see 83 FR at 19939).

However, upon consideration of commenters’ concerns, and particularly those regarding the risk of cumulative airborne exposure from contaminated PPE, OSHA has determined that removing this provision would insufficiently protect employees who already have airborne exposure above the PEL from the additional inhalation risk that could occur if they were allowed to remove their PPE from the worksite without first properly cleaning it. As OSHA explained in the NPRM and previously in this Summary and Explanation, where employees working with materials containing trace concentrations of beryllium have reasonably expected airborne exposure above the TWA PEL or STEL due to their work activity, and would thus be required to use PPE under paragraph (h)(1), they will likely be working in highly dusty environments that could accumulate large amounts of dust on their PPE (84 FR at 53913). OSHA finds that it is appropriate to ensure that such workers clean their PPE in accordance with paragraph (h)(3)(ii) prior to removing it from the worksite to prevent them from being further exposed to airborne beryllium if the dust on their PPE were to be re-entrained in their vehicles or homes. Therefore, rather than removing paragraph (h)(2)(iv) entirely, OSHA is revising the provision (and renumbering it as (h)(2)(iii)) to require the employer to ensure that no employee with reasonably expected exposure above the TWA PEL or STEL removes PPE required by the beryllium standard from the workplace unless it has been cleaned in accordance with paragraph (h)(3)(ii).

As explained below, the provisions that OSHA is removing in this final rule from paragraphs (h)(2) and (3) (specifically, former paragraphs (h)(2)(iii) and (v) and (h)(3)(iii)) do not further the goal of preventing workers from encountering beryllium-containing dust that could be re-entrained in the air and exacerbate an already-significant lung burden. OSHA has therefore determined that the provisions are unnecessary.

As discussed above, former paragraph (h)(2)(iii) required the employer to ensure that each employee stores and keeps beryllium-contaminated PPE from street clothing and that storage facilities prevent cross-contamination as specified in the written exposure control plan required by paragraph (f)(1) of this standard, but PPE cannot become “beryllium-contaminated,” as OSHA has defined that term (see 83 FR at 19939), in the operations to which these standards are being tailored. Moreover, OSHA has determined that it is unnecessary to retain and revise former paragraphs (h)(2)(iii) so that it applies to PPE required by the beryllium standards, as OSHA has done for (h)(2)(ii) and (h)(3)(ii), because such a provision would not provide protection beyond that already provided by OSHA’s sanitation standards in construction and shipyards.

The sanitation standards for both construction and shipyards require employers to provide change rooms under certain circumstances. As explained in the Summary and Explanation of paragraph (i), the sanitation standard for construction requires employers to provide change rooms if a particular standard requires employees to wear protective clothing because of the possibility of contamination with toxic materials (29 CFR 1926.51(i)). The change rooms must be equipped with separate storage facilities for street clothes and protective clothing. Similarly, the sanitation standard for shipyards requires change rooms when the employer provides protective clothing to prevent employee exposure to hazardous or toxic substances (29 CFR

1915.88(g)). Furthermore, the employer must provide change rooms that provide privacy and storage facilities for street clothes, as well as separate storage facilities for protective clothing.

Because the beryllium standards require PPE where exposures may exceed the TWA PEL or STEL, employers are required to provide change rooms under the sanitation standards where employees can store and keep PPE separate from street clothing to prevent cross-contamination. OSHA finds that, combined with the requirements in paragraph (h)(2)(ii) and (h)(3)(ii) regarding the safe removal and cleaning of PPE, the requirement in paragraph (f)(1) to include procedures for removing and cleaning PPE in the written exposure control plan, and the training requirements of paragraph (m), the sanitation standards' requirement allowing employees to remove and store their PPE in separate storage facilities provide the necessary protections for employees in the construction and shipyards context. Accordingly, OSHA is finalizing its proposal to revoke former paragraph (h)(2)(iii) in both standards.

As for former paragraphs (h)(2)(v) and (h)(3)(iii), which target downstream handlers of PPE, OSHA explained in the NPRM that it has no reason to believe that such individuals have airborne exposure to beryllium at levels above the TWA PEL or STEL. In response to the NPRM, no commenters provided the agency with any evidence indicating otherwise. Accordingly, OSHA finds that downstream handlers of PPE would not have airborne exposure to beryllium at levels of concern that could be exacerbated by exposure to any residual dust encountered during the PPE removal, laundering, cleaning or repair process. And, given that the operations to which OSHA is tailoring the standards only involve materials containing trace concentrations of beryllium and/or do not pose a significant risk of skin contamination, and that OSHA only intended for the standards to prevent contact with materials containing trace concentrations of beryllium when there are significant airborne exposures at levels of concern,

former paragraphs (h)(2)(v) and (h)(3)(iii) are not necessary to protect downstream handlers of PPE from dermal contact with beryllium.

As for AFL-CIO's criticism that the agency has not produced evidence to prove that downstream workers are *not* exposed to airborne beryllium at levels above the TWA PEL or STEL, OSHA has no obligation or authority to prescribe remedies for problems for which it has no evidence of their existence. OSHA did not have evidence of any such exposure when it promulgated the standards in 2017, and its inclusion of the protections for downstream handlers of PPE in the 2017 final rule was due to the agency borrowing provisions from the general industry standard without appropriately accounting for only trace exposures to beryllium in abrasive blasting and welding operations as they pertain to dermal contact.

With the exception of former paragraph (h)(2)(iv) (renumbered as (h)(2)(iii)), AFL-CIO's and NABTU's comments have not persuaded the agency that any of the provisions that it proposed to remove from paragraphs (h)(2) and (3) are necessary to protect workers in construction and shipyards. Both commenters appear to assume that workers in the construction and shipyards industries require protection against dermal contact with beryllium, but as explained above, the operations to which OSHA is tailoring the construction and shipyards standards do not pose a risk of dermal contact with beryllium in greater-than-trace concentrations, and OSHA never intended to protect against such contact unless the individual has exposure to airborne beryllium at levels exceeding the TWA PEL or STEL. Furthermore, as explained in the Summary and Explanation for paragraph (f), the Virji et al. study, to which both AFL-CIO and NABTU cite, likely does not reflect current conditions in general industry facilities, and thus does not establish that construction employees who enter a general industry site today would require protection from dermal contact with beryllium in more than trace

amounts. OSHA has determined that, given the data-supported operations that produce exposures of concern in this context, the revised paragraphs (h)(2) and (3), working in concert with other relevant provisions in the standards, provide workers with the necessary protection against the additional inhalation exposure that could be posed by the spread of dust containing trace amounts of beryllium.

Several other commenters responded that OSHA's proposed changes to paragraph (h) do not go far enough, and that none of the beryllium standards' ancillary provisions, including the PPE provision, are necessary (Document ID 2203, p. 1-2, 11; 2199, p. 3; 2205, p. 2; 2206, pp. 10-13; 2209, pp. 1-2; 2241, pp. 3-4). CISC specifically commented that, because abrasive blasting employees already wear PPE, OSHA has not established that requiring the provision and use of PPE when employees have reasonably expected airborne exposure to beryllium above the TWA PEL or STEL will significantly reduce the risk of harm (Document ID 2203, p. 11; 2241, p. 3). ABMA similarly claimed that "[t]here is no evidence that the pre-existing standards governing abrasive blasting are insufficient to protect employees, and there is no evidence that exposure to the trace amounts of naturally occurring beryllium in abrasive blasting (or welding) has resulted in any material impairment of health to employees in all of the many years this work has been performed" (Document ID 2206, p. 11).

OSHA did not propose in this rulemaking to remove the standards' PPE requirements in their entirety, and in fact, explained in the NPRM that it determined in the 2019 final rule that removing paragraph (h) in its entirety would not sufficiently protect workers from airborne exposure to beryllium (84 FR at 53913). OSHA acknowledged that other standards already require some employees engaged in abrasive blasting and welding operations in the construction and shipyards sectors to use PPE. However, some workers with known exposure to beryllium in

construction and shipyards, such as abrasive blasting helpers, would not be fully protected if OSHA revoked the requirements for PPE in their entirety. In addition, other OSHA standards do not provide specific PPE removal, cleaning, and maintenance requirements. As explained above, the PPE removal and cleaning provisions in these standards are necessary to minimize the spread of beryllium-containing dust, which, if re-entrained could create additional inhalation exposures for workers with reasonably expected airborne exposure to beryllium at levels exceeding the TWA PEL or STEL. Commenters have provided no new information indicating that such protections are unnecessary, and OSHA finds that the PPE provisions that it is promulgating in paragraph (h) are necessary and appropriate to protect workers in the construction and shipyards industries.

Former Paragraph (i) Hygiene Areas and Practices

In this final rule, OSHA is removing paragraph (i), hygiene areas and practices, from the beryllium standards for construction and shipyards. OSHA has acknowledged the importance of hygiene practices throughout the beryllium rulemaking process (see, e.g., 82 FR at 2684-85; 84 FR at 53915). However, it has also acknowledged that the sanitation standards in general industry (29 CFR 1910.41), construction (29 CFR 1926.51), and shipyards (29 CFR 1915.88) include provisions similar to some of those in the beryllium standards (84 FR at 53914). In the NPRM, OSHA explained that it was reconsidering the need to include additional, beryllium-specific hygiene requirement in the construction and shipyards standards, in light of the specific exposure sources in these industries; specifically, abrasive blasting operations involving beryllium in trace amounts and limited welding operations in which dermal exposure is not a concern (84 FR at 53914-15).

Based on the evidence in the record and after reviewing the comments and hearing testimony pertaining to hygiene areas and practices, OSHA has determined that the sanitation standards for construction (29 CFR 1926.51) and shipyards (29 CFR 1915.88) provide protections comparable to those in paragraph (i) of the beryllium standards for construction and shipyards and that additional requirements will not materially increase protections in these sectors. Accordingly, OSHA is removing paragraph (i) from the beryllium standards for construction and shipyards.

Paragraph (i) of the 2017 final rule established requirements for hygiene areas and practices in general industry (29 CFR 1910.1024), construction (29 CFR 1926.1024), and shipyards (29 CFR 1915.1024). As promulgated in 2017, paragraph (i) required employers in all three industries to: (1) Provide readily accessible washing facilities to remove beryllium from the hands, face, and neck (paragraph (i)(1)(i)); (2) ensure that employees who have dermal contact with beryllium wash any exposed skin (paragraph (i)(1)(ii)); (3) provide change rooms if employees are required to use personal protective clothing and are required to remove their personal clothing (paragraph (i)(2)); (4) ensure that employees take certain steps to minimize exposure in eating and drinking areas (paragraph (i)(3)); and (5) ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in areas where there is a reasonable expectation of exposure above the TWA PEL or STEL (paragraph (i)(4)).

After publishing the 2017 final rule, OSHA clarified in a direct final rule (DFR) for general industry that the agency only intended to regulate contact with trace beryllium to the extent that it causes airborne exposures of concern (83 FR at 19938). Unlike in general industry, where processes involving exposure to beryllium are varied and employees are exposed to a variety of materials that can contain high concentrations of beryllium, exposures in the

construction and shipyards industries are primarily limited to abrasive blasting operations in construction and shipyards and a small number of welding operations in shipyards (Document ID 2042, FEA Chapter III, pp. 103-11 and Table III-8e) (see the Summary and Explanation for paragraph (f)(1) for a discussion of the potential for additional sources of exposure in these sectors). While the extremely high airborne exposures during abrasive blasting operations can expose workers to beryllium in excess of the PEL, the blasting materials contain only trace amounts of beryllium (Document ID 2042, FEA Chapter IV, p. 612). Moreover, the record before the agency contains evidence of beryllium exposure during only limited welding operations in shipyards (Document ID 2042, FEA Chapter III, Table III-8e) and as discussed previously, OSHA has determined that for these limited welding operations the exposure of concern is exposure to airborne beryllium and not dermal contact.

In the NPRM, OSHA preliminarily determined that, based on the trace beryllium content of blasting materials and the available information on welding operations, the construction and shipyards sectors do not have operations where skin or surface contamination in the absence of significant airborne exposures is an exposure source of concern (84 FR at 53906, 53914-15). In light of the existing OSHA standards providing many of the same protections as the beryllium standards, the limited operations where beryllium exposure may occur in construction and shipyards, and the trace quantities of beryllium present in construction and shipyard operations, OSHA preliminarily determined that the requirements for hygiene areas and practices in the 2017 beryllium standards for construction and shipyards may be unnecessary to protect employees in these industries and proposed to remove all provisions of paragraph (i) from the construction and shipyard standards (84 FR 53915-16). Accordingly, the agency proposed to remove paragraph (i) from the construction and shipyard standards (84 FR at 53916). Detailed

explanations of each provision and OSHA's reasoning for removing them are presented below, along with discussion of and response to comments received on the proposal.

Paragraph (i)(1) of both the construction and shipyards standards required that, for each employee required to use PPE by the standard, employers provide readily accessible washing facilities for use in removing beryllium from the hands, face, and neck (paragraph (i)(1)(i)), and ensure employees who have dermal contact with beryllium wash any exposed skin at the end of the activity, process, or work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet (paragraph (i)(1)(ii)). OSHA proposed to remove these provisions because existing standards already require the use of washing facilities for workers in construction and shipyards.

The sanitation standard for construction (29 CFR 1926.51(f)) requires employers to provide adequate washing facilities maintained in a sanitary condition for employees engaged in operations where contaminants may be harmful to the employees. It also requires that these washing facilities must be in proximity to the worksite and must be so equipped as to enable employees to remove such substances. Lavatories are also required at all places of employment and must be equipped with hot and cold running water, or tepid running water. Hand soap or similar cleansing agents must be provided along with hand towels, air blowers, or clean continuous cloth toweling, convenient to the lavatories. The sanitation standard for shipyards (29 CFR 1915.88(e)) similarly requires employers to provide handwashing facilities at or adjacent to each toilet facility. The criteria for these handwashing facilities are similar to the construction industry in that they must be equipped with hot and cold running water or tepid running water, soap, or skin cleansing agents capable of disinfection or neutralizing the contaminant, and drying materials and methods. This standard further requires the employer to inform each employee

engaged in operations in which hazardous or toxic substances can be ingested or absorbed about the need for removing surface contaminants from their skin's surface by thoroughly washing their hands and face at the end of the work shift and prior to eating, drinking, or smoking (see 29 CFR 1915.88(e)(3)). Even though the sanitation standards do not specifically mention beryllium, the use of the terms harmful substances in the construction sanitation standard and hazardous or toxic substance in the shipyard sanitation standard encompass beryllium exposure where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL.

With respect to abrasive blasting, the sanitation standards' washing facilities requirements are triggered by the use of blasting media; either due to contaminants in the blasting media (which may include beryllium, lead, hexavalent chromium, cadmium, and arsenic) or contamination from the substrate or coatings on the substrate. Similarly, in the limited welding operations involving beryllium exposure, workers will likely be exposed to other hazardous chemicals (including hexavalent chromium, lead, and cadmium) (see <https://www.osha.gov/SLTC/weldingcuttingbrazing/chemicals.html>), triggering the requirements of the sanitation standards. Accordingly, the sanitation standards provide comparable protections to the washing facilities requirements that OSHA is proposing to remove from both the construction and shipyard standards (paragraphs (i)(1)(i) and (ii)).

OSHA also proposed to remove paragraph (i)(2), which required employers to provide change rooms where employees are required to remove their personal clothing in order to don PPE (paragraph (i)(2)), because the sanitation standards already provide comparable protections (84 FR at 53915). The sanitation standard for construction (29 CFR 1926.51(i)) requires employers to provide change rooms if a particular standard requires employees to wear protective clothing because of the possibility of contamination with toxic materials. The change

rooms must be equipped with storage facilities for street clothes and separate storage facilities for the protective clothing must be provided. Similarly, the sanitation standard for shipyards (29 CFR 1915.88(g)) requires change rooms when the employer provides protective clothing to prevent employee exposure to hazardous or toxic substances. Furthermore, the employer must provide change rooms that provide privacy and storage facilities for street clothes, as well as separate storage facilities for protective clothing. Because the beryllium standards require PPE where exposures may exceed the TWA PEL or STEL, employers are required to provide change rooms under the sanitation standards, just as they would have been required by paragraph (i)(2) of the beryllium standards.

OSHA further proposed to remove paragraph (i)(3) from the construction and shipyards standards, which established requirements for eating and drinking areas. Paragraph (i)(3)(i) required that surfaces in eating and drinking areas be kept as free as practicable of beryllium and paragraph (i)(3)(ii) required that employees remove or clean contaminated clothing prior to entering these areas. OSHA proposed to remove these provisions for two reasons. First, provisions in the sanitation standards for construction (29 CFR 1926.51(g)) and shipyards (29 CFR 1915.88(h)) already require employers to ensure that food, beverages, and tobacco products are not consumed or stored in any area where employees may be exposed to hazardous or toxic materials. Second, these provisions relate to minimizing dermal contact.²⁹ As explained in the Summary and Explanation for paragraph (h), OSHA intends that provisions aimed at addressing dermal contact should only apply to materials containing trace amounts of beryllium where there is also the potential for significant airborne exposure. OSHA preliminarily determined that the

²⁹ In the 2019 construction and shipyards final rule, in which OSHA declined to revoke all of the ancillary provisions of these standards, OSHA stated that there was not complete overlap between the sanitation standards and the eating and drinking area requirements of paragraph (i)(3) (84 FR at 51395). That rule, however, did not address whether additional beryllium-specific requirements were necessary in light of the trace exposures in these contexts.

processes in construction and shipyards creating exposure to beryllium are either processes that involve materials containing less than 0.1 percent beryllium by weight or processes that do not produce surface or skin contamination (84 FR at 53916).

OSHA further explained that other parts of the beryllium standard will reduce the potential for airborne beryllium in eating and drinking areas (84 FR at 53916). Specifically, when employees are cleaning up dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposures over the TWA PEL or STEL, the employer must ensure the use of methods that minimize the likelihood and level of airborne exposure (see paragraph (j)). And under proposed paragraph (h)(2)(ii), employers must ensure that PPE required by the standard is not removed in a manner that disperses beryllium into the air. Given that the construction and shipyard operations known to involve beryllium exposure involve only trace amounts of beryllium (or, in the case of welding, do not pose a dermal contact risk), and that other provisions of the beryllium standard such as engineering controls and housekeeping requirements serve to minimize airborne exposures, OSHA preliminarily determined that existing standards adequately protect employees in eating and drinking areas (84 FR at 53916).

OSHA also proposed to remove the reference in paragraph (i)(3)(iii) which required that eating and drinking facilities provided by the employer must be in accordance with the sanitation standards. OSHA does not believe it is necessary to maintain this reference, as this would be the only requirement remaining in paragraph (i) and employers are required to comply with the sanitation standards regardless.

Finally, OSHA proposed to remove paragraph (i)(4), which required the employer to ensure that no employees eat, drink, smoke, chew tobacco or gum, or apply cosmetics in work areas where there is a reasonable expectation of exposure above the TWA PEL or STEL. The

sanitation standards prohibit consuming food or beverages in areas exposed to toxic material and therefore provides the appropriate protections for areas where exposures are above the PEL.

OSHA preliminarily determined that the sanitation standards are substantially similar to former paragraph (i)(4) and provide appropriate protections for areas where exposures are above the PEL (84 FR at 53916).

In the 2019 NPRM, OSHA requested comment on the proposed removal of paragraph (i), especially comments and data on the use of wash facilities and change rooms in construction and shipyards for operations that would be covered by the beryllium standards (84 FR at 53916).

Several commenters disagreed with OSHA that the hygiene provisions under paragraph (i) should be rescinded. AFL-CIO commented that removing paragraph (i) will increase workers' risk of cumulative beryllium exposure and could lead to migration of beryllium to other areas, resulting in inhalation exposure to other workers (Document ID 2210, p. 8). They argued that the sanitation standards leave gaps in coverage, in light of "the significant risk of impairment to worker health at low exposure limits and the carcinogenicity of beryllium," and that other provisions of the beryllium standard addressing airborne exposure are insufficient to justify removing the hygiene provisions (Document ID 2210, p. 8). In post-hearing comments, AFL-CIO reiterated their position and stated that the 2017 final rule found paragraph (i) "prevents additional airborne and dermal exposure to beryllium, accidental ingestion of beryllium, spread of beryllium inside and outside the workplace and reduces significant risk of beryllium sensitization and CBD" (Document ID 2239, p. 2).

AFL-CIO did not identify which protections in paragraph (i) are left unaddressed by the sanitation standards. With respect to increases in cumulative exposure or migration of beryllium resulting in increased airborne exposure, OSHA has explained that the sanitation standards for

construction and shipyards contain comparable requirements for change rooms (29 CFR 1926.51(i); 29 CFR 1915.88(g)) and washing facilities (29 CFR 1926.51(f); 29 CFR 1915.88(e)) and prohibit contamination in eating and drinking areas (29 CFR 1926.51(g); 29 CFR 1915.88(h)). At the same time, existing provisions of the beryllium standards further reduce the potential for airborne exposure by ensuring beryllium-containing dust is cleaned up by methods that minimize the likelihood and level of such exposure (paragraph (j)) and that PPE is removed and cleaned in a manner that does not disperse beryllium into the air (paragraphs (h)(2) and (3)). Regarding the need for provisions to protect against dermal contact, OSHA has explained that it does not intend such provisions to apply where, as here, exposure involves materials containing only trace amounts of beryllium (see the Summary and Explanation for paragraph (h)). Ultimately, OSHA disagrees with the AFL-CIO's broad and unelaborated assertion that these protections are inadequate.

NABTU, resubmitting comments previously entered in the docket, argued that the hygiene provisions “provide protections not only for abrasive blasting workers, but for all construction workers who may be exposed to beryllium,” including workers who perform maintenance, repair, renovation, or demolition of worksites that contain beryllium (Document ID 2202, 2017 comment, p. 7; see also Document ID 2202, 2015 comment, p. 9). According to NABTU, providing washing and clean-up facilities to beryllium-exposed workers benefits all workers at the site, “especially those who don't perform beryllium-exposing tasks, who may not be aware of the hazards of beryllium” (Document ID 2202, 2017 comment, p. 7). At the public hearing, when asked which hygiene provisions they viewed as important for abrasive blasting operations in construction, NABTU's representative identified “handwashing facilities . . . [and]

the ability to change out of clothing that's contaminated with the dust" (Document ID 2222, Tr. 105).

In their post-hearing brief, NABTU again emphasized their position that OSHA should retain provisions related to dermal contact in construction and argued that the sanitation standard for construction lacks "the level of specificity necessary to ensure construction workers adequate protection" (Document ID 2240, p. 8). Specifically, although paragraph (f) of the sanitation standard requires construction employers to provide washing facilities, NABTU notes that it does not specify that workers must use these facilities following dermal contact with beryllium and before "eating drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet" (Document ID 2240, p. 9). And although paragraph (g) prohibits eating or drinking in "any area exposed to a toxic material," NABTU asserts that it "does not address the range of activities covered by the beryllium standard" (Document ID 2240, p. 9). Finally, they state that the sanitation standard does not require employees to remove surface beryllium from their clothing or PPE before taking the equipment into an eating or drinking area (Document ID 2240, p. 9).

OSHA agrees with NABTU that washing and clean-up facilities benefit all workers at a worksite and that all workers with beryllium exposure should be protected. However, the agency has determined that a beryllium-specific requirement is not necessary to provide these protections in the construction context. OSHA has determined that the sanitation standard for construction provides the same protections as the beryllium standard with respect to washing facilities (29 CFR 1926.51(f)) and change rooms (29 CFR 1926.51(i)).

OSHA disagrees with NABTU that the sanitation standard for construction lacks sufficient specificity to protect workers in the construction industry. First, with respect to the

previous requirement in paragraph (i)(1)(ii) that employees with dermal contact wash exposed skin prior to “eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet,” this requirement was triggered on and specifically aimed at addressing dermal contact (82 FR at 2684).³⁰ OSHA has addressed commenters’ concerns regarding dermal contact previously in this preamble (see the Summary and Explanation for paragraph (f)), and simply notes again its determination that this is not an exposure source of concern in the construction operations known to involve beryllium exposure.

The same rationale applies to NABTU’s concerns regarding the list of prohibited activities as they appear in paragraph (i)(4). OSHA initially included these provisions due to the risk of “beryllium contaminating the food, drink, tobacco, gum, or cosmetics” (82 FR at 2688). Having received no comments related to this provision when OSHA original proposed it for the general industry standard, OSHA extended “substantively identical” requirements to the construction and shipyards standards in the 2017 final rule (82 FR at 2688). In light of OSHA’s determination in this final rule that exposures in the construction and shipyards sectors are limited to trace amounts of beryllium, the agency finds that this is no longer a concern in these sectors. Next, after considering NABTU’s assertion that the sanitation standard does not require employees to remove surface beryllium from their clothing or PPE before taking the equipment into an eating or drinking area, OSHA has reviewed the existing requirements of 29 CFR 1926.51 and determined that this is not the case. If an area contains PPE covered with surface beryllium, such that employees may be exposed through re-entrainment of the beryllium-

³⁰ In the general industry DFR, the agency revised the definition of “dermal contact with beryllium” to apply only to skin exposure to beryllium “in concentrations greater than or equal to 0.1 percent by weight” (83 FR at 19940). OSHA notes that under this revised definition of dermal contact, the requirement in paragraph (i)(1)(ii) would never be triggered in the context of abrasive blasting operations in construction and shipyards.

containing dust, 29 CFR 1926.51(g) by its terms prohibits employees from consuming or storing food, beverages, or tobacco products in that area.

NJH commented that, although there is “likely some overlap” between the beryllium and sanitation standards, it is important to ensure that “special protections” are in place to protect workers from beryllium exposures (Document ID 2211, p. 10). NJH specifically noted that contaminated change rooms may potentially expose workers not otherwise working with or exposed to beryllium (Document ID 2211, p. 10). OSHA notes that paragraph (i)(2) in each of the beryllium standards required employers to provide change rooms in accordance with the beryllium standard and the relevant sanitation standard, when an employee is required to change from street clothes to don PPE (29 CFR 1926.1124(i)(2); 29 CFR 1915.1024(i)(2)). Paragraph (h)(2)(iii) of the beryllium standards, in turn, required employers to ensure that beryllium-contaminated PPE is kept separate from street clothes and that storage facilities prevent cross-contamination (29 CFR 1926.1124(h)(2)(iii); 29 CFR 1915.1024(h)(2)(iii)). However, the sanitation standards each also require that change rooms contain separate storage facilities for street clothes and PPE to prevent cross-contamination (29 CFR 1926.51(i); 29 CFR 1915.88(g)). OSHA finds that, combined with the requirements in paragraph (h)(2) and (3) of the beryllium standards regarding the safe removal and cleaning of PPE, the sanitation standards for construction and shipyards protect against contamination of required change rooms to the same extent as paragraph (i).

Finally, one commenter argued that paragraph (i) must be included for “implementation and consistency with other comprehensive health standards” (Document ID 2197). However, the commenter did not identify how relying on the sanitation standards would result in implementation issues. With respect to consistency, although it is true that some health standards

contain substance-specific hygiene requirements, the breadth and content of the requirements differ by standard. For example, the hygiene requirements of the methylene chloride standard (29 CFR 1926.1152) address only the provision of washing facilities, while the requirements in other standards, such as the cadmium standard (29 CFR 1926.1127), contain numerous, more detailed requirements. Other health standards, such as the standards for vinyl chloride (29 CFR 1926.1117), benzene (29 CFR 1926.1128), and respirable crystalline silica (29 CFR 1926.1153), contain no substance-specific hygiene requirements at all and rely solely on the general sanitation standard. Thus, relying on the sanitation standards rather than beryllium-specific hygiene requirements will not create inconsistency among OSHA's comprehensive health standards.

OSHA has reviewed these comments and the record as a whole and has decided to follow through with the proposed removal of paragraph (i). In light of existing OSHA sanitation standards which provide protections comparable to those in paragraph (i) of the beryllium standards for construction and shipyards and the trace quantities of beryllium present in these industries (or, in the case of welding operations, the lack of skin or surface contamination), OSHA has determined that additional, beryllium-specific hygiene requirements will not materially increase protections for workers in these industries. Accordingly, the agency is removing former paragraph (i) from the construction and shipyard standards. By doing so, OSHA intends to tailor the beryllium standards for construction and shipyards to ensure they are no more complicated or onerous than necessary to appropriately protect workers, thereby improving compliance.

Paragraph (j) Housekeeping

In this final rule, paragraph (j) of the construction and shipyards standards mandates several housekeeping requirements aimed at reducing workers' airborne exposure to beryllium. Paragraph (j)(1) requires employers to use cleaning methods that minimize the likelihood and level of airborne exposure to beryllium when cleaning up dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL. Paragraph (j)(2) prohibits dry sweeping or brushing for cleaning up dust from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL unless other methods that minimize the likelihood and level of airborne exposure are not safe or effective. Paragraph (j)(3) prohibits the use of compressed air for cleaning if its use causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL. Paragraph (j)(4) requires respirator use and personal protective clothing and equipment where employees use dry sweeping, brushing, or compressed air to clean. Finally, paragraph (j)(5) requires cleaning equipment to be handled and maintained in a manner that minimizes the likelihood and level of airborne exposure and re-entrainment of airborne beryllium in the workplace.

This final rule includes several changes from paragraph (j) as promulgated in the 2017 final rule. As OSHA explained in the proposal, the agency acknowledged in the 2017 final rule that different approaches may be warranted for the housekeeping provisions for construction and shipyards than for general industry due to the nature of the materials and identified work processes with beryllium exposure in construction and shipyards (82 FR at 2690). OSHA recognized that beryllium exposure in these industries is limited primarily to abrasive blasting in construction and shipyards and a small number of welding operations in shipyards (Document ID 2042, FEA Chapter III, pp. 103-11 and Table III-8e). While the extremely high airborne dust

exposures during abrasive blasting operations can expose workers to beryllium in excess of the PEL, slag-based abrasive media contains only trace amounts of beryllium (Document ID 2042, FEA Chapter IV, p. 612). Moreover, the record before the agency contains evidence of beryllium exposure during only limited welding operations in shipyards (Document ID 2042, FEA Chapter III, Table III-8e). Nonetheless, in the 2017 final rule, OSHA applied most of the same requirements to these industries as to general industry,³¹ where the operations with beryllium exposure are significantly more varied and employees are exposed to materials with significantly higher beryllium content.

Since publication of the 2017 final rule, OSHA has undertaken several additional rulemaking efforts affecting the beryllium standards for construction and shipyards. OSHA clarified in the beryllium general industry DFR that the agency only intended to regulate contact with trace beryllium to the extent that it caused airborne exposures of concern. OSHA explained that the agency never intended for provisions aimed primarily at protecting workers from the effects of dermal contact to apply in the case of materials containing only trace amounts of beryllium (83 FR at 19938).

OSHA also published its 2017 proposal to revoke the ancillary provisions of the construction and shipyards beryllium standards in light of overlap with existing OSHA standards applicable to these sectors (82 FR 29182). With respect to the housekeeping provisions of paragraph (j), OSHA identified existing standards that at least partially duplicated the requirements of the beryllium standards. Specifically, OSHA cited the construction ventilation

³¹ Due to the transient nature of the work processes in construction and shipyards and the fact that most of the work occurs outside, OSHA decided not to require employers in these industries to maintain all surfaces as free as practicable of beryllium, as it had done in general industry. Rather, the agency required employers in these industries to follow their written exposure control plan when cleaning beryllium-contaminated areas (82 FR at 2690).

standard, which requires that dust not be allowed to accumulate outside abrasive blasting enclosures and that spills be cleaned up promptly (29 CFR 1926.57(f)(7)). OSHA also identified certain provisions of OSHA's general ventilation standard for abrasive blasting (29 CFR 1910.94(a)), which apply to abrasive blasters in shipyards, and require that dust must not be permitted to accumulate on the floor or on ledges outside of an abrasive-blasting enclosure, and dust spills must be cleaned up promptly. (29 CFR 1910.94(a)(7)). Although OSHA ultimately determined that existing standards did not duplicate all of the requirements of paragraph (j), the agency acknowledged that certain revisions may be appropriate to account for partial overlap in these standards (84 FR at 51378).

In the 2019 NPRM, OSHA announced that it was reconsidering its approach to the housekeeping provisions in the construction and shipyards standards based primarily on two rationales. First, OSHA preliminarily determined that skin or surface contamination in the absence of significant airborne exposures is not an exposure source of concern in the operations with known beryllium exposure in the construction and shipyards sectors; that is, abrasive blasting with material containing trace quantities of beryllium and limited welding operations in shipyards. Second, OSHA preliminary determined that partial overlap between paragraph (j) and existing OSHA standards made certain revisions to these requirements appropriate (84 FR at 53916-17). Accordingly, OSHA proposed a number of changes to paragraph (j) in both standards.

First, OSHA proposed to remove paragraph (j)(1), which required employers to follow the written exposure control plan in paragraph (f) when cleaning beryllium-contaminated areas and to ensure that spills and emergency releases of beryllium are cleaned up promptly and in accordance with the written exposure control plan (84 FR at 53917). OSHA explained that

routine general housekeeping and housekeeping related to spills are adequately covered by the existing ventilation standard for construction (29 CFR 1926.57(f)(7)) and OSHA's general ventilation standard (29 CFR 1910.94(a)) applicable to shipyards (84 FR at 53917). OSHA also explained that because the housekeeping provisions are triggered by only one operation (abrasive blasting) using materials with trace amounts of beryllium and the main objective of these provisions is to minimize airborne exposure, a unique written plan for how to clean is unnecessary in this context. OSHA noted that this is in contrast to general industry, where there is the concern for protecting workers from both airborne exposures and dermal contact over a variety of beryllium-containing materials and processes and where employers may need to have more complicated or unique cleaning procedures to adequately protect workers. Finally, with respect to emergency releases of beryllium, OSHA elsewhere in the proposal preliminarily determined that the operations with beryllium exposure in the construction and shipyards sectors do not have emergencies in which exposures differ from the normal conditions of works (see 84 FR at 53909), rendering housekeeping procedures specific to emergency releases unnecessary.

OSHA also proposed revising paragraph (j)(2), which addressed the use of cleaning methods that minimize the likelihood and level of airborne exposure, the use of dry sweeping, brushing and compressed air for cleaning, the use of respiratory protection and personal protective equipment when employing certain types of cleaning methods, and handling and maintaining cleaning equipment (84 FR at 53917). The first proposed revision relates to paragraph (j)(2)(i), renumbered as (j)(1), which required the use of HEPA-filtered vacuuming or other methods that minimize the likelihood and level of airborne exposure when cleaning in beryllium-contaminated areas. The second proposed revision relates to paragraph (j)(2)(ii), renumbered as (j)(2), which prohibited dry sweeping or brushing for cleaning in beryllium-

contaminated areas unless HEPA-filtered vacuuming or other methods that minimize the likelihood and level of airborne exposure are not safe or effective.

In both paragraphs, OSHA proposed replacing the phrase “cleaning in beryllium-contaminated area” with “cleaning up dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL” (84 FR at 53917). In the 2018 DFR, OSHA clarified the general industry beryllium standard by defining “contaminated with beryllium” and “beryllium-contaminated” as contaminated with dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight; a condition not applicable to abrasive blasting operations in construction and shipyards (84 FR at 53917; 83 FR at 19939-40). Because the agency preliminarily determined that there are no operations covered by the construction or shipyard beryllium standards that would create such a beryllium-contaminated surface, the agency proposed to revise these portions of renumbered paragraphs (j)(1) and (2). OSHA explained that the agency intends these provisions to apply where workers are either working in regulated areas in shipyards or in areas with exposures above the TWA PEL or STEL in construction. As such, OSHA preliminarily determined that the presence of dust produced by operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL is a more appropriate trigger for these requirements (84 FR at 53917).

OSHA also proposed to remove the references to “HEPA-filtered vacuuming” in renumbered paragraphs (j)(1) and (2) and instead to refer simply to methods that minimize the likelihood and level of airborne exposure. OSHA explained that in abrasive blasting operations, where large amounts of dust are generated, the use of such vacuums may be problematic due to filter overload and clogging which may cause additional exposures (84 FR at 53917). Because

the use of HEPA-filtered vacuums may not be appropriate in abrasive blasting operations, OSHA proposed to revise paragraph (j) of both standards to remove the references to such vacuums.

OSHA next proposed to revise paragraph (j)(2)(iii), renumbered as paragraph (j)(3), which prohibited the use of compressed air for cleaning in beryllium-contaminated areas unless the compressed air is used in conjunction with a ventilation system designed to capture the particulates made airborne by the use of compressed air (84 FR at 53917). OSHA again proposed to remove the reference to “beryllium-contaminated areas” for reasons already discussed. OSHA also proposed to prohibit the use of compressed air for cleaning where its use causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL, without reference to the use of ventilation. OSHA explained that in the 2017 final rule, the agency determined that the use of compressed air might occasionally be necessary in general industry (84 FR at 53918; see 82 FR at 2693). Similarly, for construction and shipyards, OSHA intended at the time to prohibit the use of compressed air during cleaning of beryllium contaminated areas or materials designated for recycling or disposal unless used in conjunction with a ventilation system (84 FR at 53918). In the proposal, OSHA stated that the agency was now reconsidering the practicality of using ventilation with compressed air when cleaning areas with copious amounts of dust produced during abrasive blasting at construction and shipyard sites. Instead, OSHA proposed to limit the use of compressed air to circumstances in which there is a limited quantity of dust, which, if re-entrained, would not result in exposures above the TWA PEL or STEL (84 FR at 53918).

OSHA next proposed revising paragraph (j)(2)(iv), renumbered as paragraph (j)(4), which addressed respirator use and personal protective clothing and equipment where employees use dry sweeping, brushing, or compressed air to clean in beryllium-contaminated areas. OSHA

again proposed to remove the reference to “beryllium-contaminated areas” for reasons already discussed and to instead simply require the use of respiratory protection and PPE “in accordance with paragraphs (g) and (h)” when dry sweeping, brushing, or compressed air is used (84 FR at 53918).

Finally, OSHA proposed removing the disposal provision in paragraph (j)(3), which required that, when transferring beryllium-containing materials to another party for use or disposal, employers must provide the recipient a copy of the warning label required by paragraph (m) (84 FR at 53918). Separately in the proposal, OSHA proposed removing the labeling requirement in paragraph (m) altogether. OSHA explained that all beryllium-containing materials in the shipyard and construction industries contain or produce only trace amounts of beryllium. Accordingly, OSHA explained, this revision is consistent with OSHA’s intention, explained in the 2018 DFR, that provisions aimed at protecting workers from the effects of dermal contact should not apply to materials containing only trace amounts of beryllium, such as abrasive blasting media, unless those workers are also exposed to airborne beryllium at or above the action level (84 FR at 53918; see 83 FR at 19940). OSHA further explained that the revision aligns with the housekeeping requirements of the general industry beryllium standard (as modified by the DFR), which does not require labeling for materials that contain only trace quantities of beryllium and are designated for disposal, recycling, or reuse (84 FR at 53918). OSHA emphasized that these materials must still be labeled according to the Hazard Communication standard (29 CFR 1910.1200) and, if appropriate, the hazards of beryllium must be addressed on the label and Safety Data Sheet (SDS) (84 FR at 53918).³² For additional discussion on labeling requirements, see the Summary and Explanation for paragraph (m)

³² OSHA also proposed some minor, non-substantive changes to paragraph (j), including renumbering existing paragraph (j)(2)(v) as paragraph (j)(5) and removing the heading for “Cleaning Methods” to refer to these

Some commenters disagreed with the proposed changes to paragraph (j) in both comments submitted to the record and in testimony at the public hearing. Many reiterated in their comments that they believe that workers in the construction and shipyard industries are exposed during activities other than abrasive blasting and welding, some of which may involve beryllium in greater-than-trace amounts. These commenters included AFL-CIO (Document ID 2210, p. 9), NJH (Document ID 2211, p. 11), NABTU (Document ID 2240, p. 9), ACOEM (Document ID 2213, p. 3), and certain members of Congress (Document ID 2208, p. 6). As in other areas of their comments, these commenters identified additional operations that they believe involve beryllium exposure, primarily the dressing of non-sparking tools and construction, maintenance, decommissioning, and demolition work at beryllium-processing facilities. With respect to the requirements of paragraph (j), some of these commenters argued that the potential for additional exposures in these operations counsel against removing any housekeeping requirements—but particularly those aimed at addressing dermal contact with beryllium—to tailor these standards to abrasive blasting and welding operations.

OSHA has addressed commenters' concerns regarding additional sources of exposure previously in this preamble in the Summary and Explanation for paragraph (f) and refers readers to that discussion. To summarize, although OSHA acknowledges the potential for exposures beyond abrasive blasting and welding operations, the record continues to lack sufficient data for the agency to characterize the nature, locations, or extent of beryllium exposure in application groups other than abrasive blasting and certain welding operations. Further, the agency has reason to believe that any additional exposures that may occur do not present a dermal contact risk in these sectors. As a result, OSHA finds that it is appropriate to further tailor certain

requirements only as “Housekeeping” (84 FR at 53918, FN 8). OSHA received no comments on these changes and is finalizing them as proposed.

provisions of the beryllium standards for construction and shipyards—including the housekeeping requirements—to those operations for which the agency has data; that is, abrasive blasting operations with material containing trace amounts of beryllium and limited welding operations where dermal contact is not an exposure source of concern.

NABTU specifically urged OSHA to retain paragraph (j)(1), which requires employers to follow their written exposure control plans when cleaning beryllium-contaminated areas and dealing with spills and emergency releases. According to NABTU, OSHA's determination that the only sources of contamination with which employers need be concerned come from abrasive blasting is incorrect and therefore the ventilation standard for construction (29 CFR 1926.57(f)(7)) does not provide adequate coverage (Document ID 2240, p. 9). Similarly, AFL-CIO disagreed with the proposed removal of this paragraph stating that the existing ventilation standards for construction and shipyards are not effective at addressing the toxicity of beryllium (Document ID 2210, pp. 8-9; 2222, Tr. 116-17).

OSHA has determined that in the context of the known exposures in construction and shipyards sectors, the previous requirements of paragraph (j)(1) do not meaningfully increase protections for workers beyond those provided by existing OSHA standards. As stated above, the ventilation standards for construction (29 CFR 1926.57(f)(7)) and general industry (29 CFR 1910.94(a)(7)), applicable to shipyards, both require that spills must be cleaned up promptly, just as required by paragraph (j)(1) of the beryllium standards. Further, beyond the requirements of paragraph (j)(1), these standards specifically require that the employer not permit dust to accumulate outside of the abrasive blasting enclosure. These standards, in conjunction with the other provisions in paragraph (j) that serve to further reduce the potential for exposures above the PEL or STEL, provide the appropriate level of protection for workers in these sectors. Further, in

light of the limited operations with beryllium exposure in these sectors, OSHA has determined that paragraph (j) provides sufficient guidance for employers on the limited circumstances in which they are allowed to use cleaning methods such as dry sweeping and compressed air, making a unique written plan for how to clean unnecessary in this context. Accordingly, the agency is removing from paragraph (j) the requirement for employers to follow the written exposure control plan in paragraph (f) when cleaning beryllium-contaminated areas and to ensure that spills and emergency releases of beryllium are cleaned up promptly and in accordance with the written exposure control plan.

AFL-CIO disagreed with what it framed as OSHA's decision to trigger the use of cleaning methods on exposures above the PEL or STEL instead of "a more conservative trigger of beryllium-contamination," claiming the agency is ignoring the risk of health effects at exposures below the PEL (Document ID 2210, p. 9). First, OSHA notes that AFL-CIO misstates the revised trigger for paragraph (j)'s cleaning requirements. OSHA intentionally drafted the requirement to use cleaning methods that minimize the likelihood and level of airborne exposure (renumbered paragraph (j)(1)) and the prohibition on dry sweeping or brushing (renumbered paragraph (j)(2)) to apply whenever an employer "cleans up dust resulting from" operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL. As explained above, OSHA intends these provisions to apply where workers are either working in regulated areas in shipyards or in areas with exposures above the TWA PEL or STEL in construction. However, the requirements apply to cleaning up dust in these areas regardless of whether the operation that produced the dust is being performed at the time of the cleaning. In other words, cleaning methods are tied to the location of operations and are not triggered on active exposure above the TWA PEL or STEL, as AFL-CIO suggests. And although revised

paragraph (j)(3) prohibits the use of compressed air for cleaning when its use can reasonably be expected to cause airborne exposure above the PEL or STEL, compressed air would not satisfy paragraph (j)(1)'s requirement for the use of cleaning methods that minimize airborne exposure unless other more effective methods were infeasible.

Further, in the general industry DFR, OSHA revised the definitions of "contaminated with beryllium" and "beryllium-contaminated" to clarify that these terms refer to contamination with dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight (83 FR at 19939-40). OSHA reiterates the agency's determination that beryllium contamination, as the agency defines it, does not occur from the trace quantities of beryllium used in abrasive blasting. OSHA has likewise determined that welding operations in shipyards do not produce this sort of skin or surface contamination. If OSHA maintained the term "beryllium-contaminated" in paragraph (j), the requirements for when and how employers can use dry sweeping, brushing, or compressed air, or when they must employ cleaning methods that minimize airborne exposure, would likely never be triggered and workers already exposed would not receive the benefit of these protections. For this reason, OSHA has determined that it is more appropriate to trigger these requirements on the presence of dust produced by an operation that causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL.

AFL-CIO also indicated that they opposed OSHA's proposal "to remove the requirement for 'HEPA filtered vacuuming'" in renumbered paragraphs (j)(1) and (2) and questioned the agency's preliminary determination that such methods may be problematic due to overloading and clogging of the filters (Document ID 2210, p. 8). AFL-CIO contended that HEPA-filtered vacuuming is commonly used and required in other OSHA dust standards and that the record

shows this method is the most effecting and safe way to clean toxic dusts and therefore should be used (Document ID 2210, pp. 8-9). OSHA disagrees with AFL-CIO's interpretation that OSHA is removing a requirement to use HEPA-filtered vacuuming. Paragraph (j) has never required the use of HEPA-filtered vacuuming, but instead required the use of HEPA-filtered vacuuming "or other methods that minimize the likelihood and level of airborne exposure." The proposed change removed the specific reference to HEPA-filtered vacuuming while maintaining the requirement that employers utilize cleaning methods that minimize the likelihood and level of airborne exposure. OSHA has always intended this requirement to be performance-oriented (see 82 FR at 2691). Further, in the 2017 final rule, OSHA acknowledged that "methods that minimize the likelihood and level of airborne exposure other than HEPA vacuuming may be appropriate for use in construction and shipyards" (82 FR at 2693). Alternative methods that are effective in minimizing the likelihood and level of airborne exposure can include the use of dust suppressants and wet methods such as wet sweeping or wet shoveling (see 82 FR at 2693).

Moreover, revised paragraphs (j)(1) and (2) do not preclude the use of HEPA-filtered vacuuming for cleaning. Removing this reference simply eliminates any misunderstanding that HEPA-filtered vacuuming is required (as AFL-CIO misinterpreted), particularly where HEPA-filtered vacuuming proves problematic for the particular situation involving the cleanup. Specifically, as OSHA noted in the proposal, abrasive blasting operations produce large amounts of spent abrasive and particulate and the use of HEPA vacuums to clean up these materials may result in continual filter overload and clogging. Constant cleaning of these filters could in fact cause additional exposures. OSHA has determined that removing the specific reference to HEPA-filtered vacuuming while continuing to allow its use is the appropriate approach for the construction and shipyards sectors.

The CISC expressed concern about OSHA's inclusion of restrictions on the use of dry sweeping and brushing for cleaning materials that contain beryllium (Document ID 2203, pp. 16-17). CISC asserted that employers will need to "assess the extent of naturally occurring beryllium in numerous construction materials to determine whether and how the restriction would apply" (Document ID 2203, p. 17). OSHA disagrees with this perceived consequence of prohibiting the use of dry sweeping and brushing. These restrictions apply only when cleaning up dust from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL (29 CFR 1926.1124(j)(2)). As explained elsewhere in this preamble, there is no evidence in the record demonstrating that naturally occurring beryllium in common construction materials at the typical construction site create exposures of concern, as CISC suggest. OSHA addresses similar assertions by CISC regarding trace amounts of naturally occurring beryllium in the Summary and Explanation for paragraph (f).

After reviewing these comments and considering the record as a whole, OSHA has determined the proposed changes addressing the use of cleaning methods and prohibiting dry sweeping or brushing will protect workers from exposure to beryllium during cleaning operations and bring clarity to the requirements of these provisions. Therefore, OSHA is adopting the changes to renumbered paragraphs (j)(1) and (2) as proposed.

AFL-CIO also raised concerns that revised paragraph (j)(3) only prohibits the use of compressed air for cleaning when the use causes, or can reasonably be expected to cause, exposures above the PEL or STEL (Document ID 2210, p. 9). AFL-CIO stated that it is a significant deviation from the current provision, which prohibits compressed air unless combined with a ventilation system. In response to OSHA's preliminary determination that ventilation may be impractical in very dusty environments like those created by abrasive blasting operations,

AFL-CIO argued that the agency has not demonstrated that the use of ventilation is infeasible or that the requirement for engineering controls should be removed, “relying only on the use of respirators..., ignoring the hierarchy of controls” (Document ID 2210, p. 9). Finally, AFL-CIO states that OSHA previously determined that prohibiting compressed air unless combined with ventilation was a practical and feasible approach in dusty environments, and that this provision is included in other dust standards (Document ID 2210, p. 9).

First, OSHA believes that AFL-CIO has misunderstood the hierarchy of the housekeeping provisions. The housekeeping requirements in paragraph (j) are triggered when workers clean up dust resulting from operations that cause, or are reasonably expected to cause, airborne exposure above the TWA PEL or STEL. Under paragraph (j)(1), when cleaning in these areas employers must ensure the use of methods that minimize the likelihood and level of airborne exposures. As explained above, the use of compressed air does not satisfy this requirement unless other more effective measures are infeasible. Following the hierarchy of controls, only after other methods that minimize exposures are shown to be ineffective or unsafe can the employer use methods such as dry sweeping, brushing, or compressed air, and then must provide and ensure the use of respiratory protection and PPE during these activities under paragraph (j)(4). Even so, under revised paragraph (j)(3), compressed air is entirely prohibited when its use causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL.

OSHA further notes that the evidence in the record demonstrates that abrasive blasting helpers, those responsible for cleaning up spent abrasive, largely have minimal exposure to beryllium. As explained in the Technological Feasibility chapter of the 2017 final rule Final Economic Analysis (FEA), of the 30 abrasive blasting cleanup workers in the exposure profile of

the FEA, two had exposures over the new PEL of 0.2 mg/m³. One cleanup worker had an 8-hour TWA sample result of 1.1 mg/m³, but blasting took place in the area during this worker's cleanup task and it is likely that the nearby abrasive blasting contributed to the sample result. The other cleanup worker had a sample result of 7.4 mg/m³, but that worker's exposure appears to be associated with the use of compressed air for cleaning in conjunction with nearby abrasive blasting (82 FR at 29197). This supports OSHA's determination that the use of compressed air can cause exposure over the PEL or STEL and, in this case, this activity would have been prohibited under revised paragraph (j)(3).

After reviewing these comments and considering the record as a whole, OSHA finds the proposed change prohibiting the use of compressed air for cleaning where its use causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL will limit the use of compressed air, such as when other methods are not feasible or effective. Also, by requiring respirator use and personal protective clothing and equipment where employees use dry sweeping, brushing, or compressed air to clean will protect workers from exposure to beryllium in circumstances when there is no feasible, alternative methods for cleaning. Therefore, OSHA is adopting the changes to paragraphs (j)(3) and (4) as proposed.

AFL-CIO also disagreed with OSHA's proposal to eliminate former paragraph (j)(3), which required the employer to provide a copy of the warning described in paragraph (m)(2) whenever it transferred materials containing beryllium to another party for use or disposal. AFL-CIO asserted that removing this provision would result in beryllium exposure to downstream employers and workers (Document ID 2210, p. 9). AFL-CIO indicated their belief that OSHA's general hazard communications standard (HCS) is not sufficient to protect downstream recipients of waste materials.

As explained in the Summary Explanation for paragraph (m), OSHA proposed to remove the labeling requirements in paragraph (m), such as the label referenced in paragraph (j)(3), to account for the trace amounts of beryllium encountered in the construction and shipyards sectors and to align these standards with the general industry beryllium standard, which does not require the labeling of material containing less than 0.1 percent beryllium by weight. OSHA reiterates its finding that the known exposures in these sectors are limited to materials containing beryllium in trace quantities and do not present a risk from dermal contact. Further, there is no evidence in the record that downstream recipients of these materials are at risk of airborne exposure above the PEL or STEL from the trace amounts of beryllium in these materials.

Moreover, OSHA explained in the NPRM that abrasive blasting media is often contaminated with several toxic chemicals such as hexavalent chromium or lead from the blasted substrate or coating on the substrate (84 FR at 53918; see OSHA Fact Sheet, Protecting Workers from the Hazards of Abrasive Blasting Materials, available at <https://www.osha.gov/Publications/OSHA3697.pdf>). AFL-CIO itself identified lead, cadmium, and arsenic as hazards associated with abrasive blasting operations (Document ID 2244, p. 11). OSHA remains concerned that providing warnings specific to beryllium for materials that contain trace beryllium and where airborne exposures are not anticipated to be significant may overshadow or dilute hazard warnings for other substances that do present a risk in this context. Neither AFL-CIO nor any other commenter contradicted this concern. OSHA finds that the general HCS requirements provide the appropriate information for spent abrasive blasting media containing only trace amounts of beryllium, where the material may be contaminated with several other toxic substances. Accordingly, OSHA is finalizing its proposal to remove former paragraph (j)(3) from the construction and shipyards standards.

In conclusion, based on the record as a whole OSHA is finalizing paragraph (j) as proposed.

Paragraph (k) Medical Surveillance

Paragraph (k) of the beryllium standard for construction and shipyards addresses medical surveillance requirements. The paragraph specifies which employees must be offered medical surveillance, as well as the frequency and content of medical examinations. It also sets forth the information that must be provided to the employee and employer. The purposes of medical surveillance for beryllium are (1) to identify beryllium-related adverse health effects so that appropriate intervention measures can be taken; (2) to determine if an employee has any condition that might make him or her more sensitive to beryllium exposure; and (3) to determine the employee's fitness to use personal protective equipment, such as respirators. The inclusion of medical surveillance in the beryllium standards for the construction and shipyard industries is consistent with Section 6(b)(7) of the OSH Act (29 U.S.C. 655(b)(7)), which requires that, where appropriate, medical surveillance programs be included in OSHA health standards to aid in determining whether the health of employees is adversely affected by exposure to the hazards addressed by the standard.

In the 2019 NPRM, OSHA proposed several revisions to paragraph (k). First, OSHA proposed removing paragraph (k)(1)(i)(C), which requires medical surveillance after exposure to beryllium during an emergency, to coincide with the removal of the term "emergency" from the standards (84 FR at 53918-19). Second, OSHA proposed minor revisions to paragraphs (k)(3)(ii)(A) and (k)(4)(i) to replace the phrase "airborne exposure to and dermal contact with beryllium" in these provisions with the simpler phrase "exposure to beryllium" (84 FR at 53919).

Finally, OSHA proposed two revisions to paragraph (k)(7)(i) to make it consistent with recent changes to the beryllium general industry standard³³ (84 FR at 53919).

With respect to OSHA's proposal to remove paragraph (k)(1)(i)(C), as discussed previously in the Summary and Explanation for paragraph (b), OSHA proposed to remove references to emergencies in the shipyards and construction standards because OSHA expects that any emergency in these industries (such as a release resulting from a failure of the blasting control equipment, a spill of the abrasive blasting media, or the failure of a ventilation system during welding operations in shipyards) would occur only during the performance of routine tasks already associated with the airborne release of beryllium; i.e., during the abrasive blasting or welding process. Therefore, employees would already be protected from exposure in such circumstances. Accordingly, OSHA preliminarily determined that no requirements should be triggered for emergencies in construction and shipyards and proposed to remove references to emergencies in provisions related to respiratory protection, paragraph (g); medical surveillance, paragraph (k); and hazard communication, paragraph (m). The agency also preliminarily determined that without these provisions it would be unnecessary to define the term *emergency* in paragraph (b) (84 FR at 53909).³⁴

Some commenters objected to the proposed removal of provisions relating to emergencies. Specifically, these commenters took issue with OSHA's preliminary determination that an uncontrolled release of beryllium in the construction and shipyards industries would not create exposures that differ from normal operations. For a full discussion of these comments and

³³ OSHA also proposed a number of minor, non-substantive edits to paragraph numbering and references to account for the addition of a new paragraph (k)(7)(ii).

³⁴ Due to the removal of paragraph (k)(1)(i)(C), OSHA is also adding the word "or" at the end of paragraph (k)(1)(i)(B) (following the semi-colon); removing a reference to paragraph (k)(1)(i)(C) from paragraph (k)(2)(i)(B); and redesignating paragraph (k)(1)(i)(D) as paragraph (k)(1)(i)(C). Consistent with that redesignation, OSHA is replacing the reference to paragraph (k)(1)(i)(D) in paragraph (k)(2)(ii) with a reference to paragraph (k)(1)(i)(C).

the agency's response, see the Summary and Explanation for paragraph (g). In short, the agency is not persuaded that the types of uncontrolled releases that necessitated emergency provisions in the general industry standard are present in the construction and shipyards industries.

Accordingly, OSHA is finalizing its proposal to remove all references to "emergency" or "emergencies" throughout the construction and shipyards standards. Because those terms no longer appear in the standards' requirements, OSHA is also finalizing its proposal to remove the definition of the term "emergency" from paragraph (b).

AFL-CIO, NABTU, and NJH specifically commented on the proposed removal of the emergency exposure trigger for a medical examination in paragraph (k). AFL-CIO opposed the removal of the emergency provisions and argued that medical surveillance should be required following an emergency (Document ID 2210, p. 9). NABTU commented that a failure of a containment used for abrasive blasting would be considered an emergency (Document ID 2222, Tr. 85-86, 91-92). NABTU also noted situations where construction workers could experience emergency exposures to beryllium in manufacturing and processing facilities, and it urged OSHA to retain the definition for emergency and other related protections, such as the trigger for an emergency examination. (Document ID 2240, p. 7). NABTU also commented that questions about emergency exposures should "be included in the medical and work histories, to ensure that pertinent information about potential exposures is not overlooked." (Document ID 2240, p. 8). In contrast, NJH agreed with OSHA that emergencies might not occur, but recommended that if the trigger for emergency exposure is removed, any exposure above the PEL should trigger medical surveillance (Document ID 2211, p. 11). Specifically, NJH commented: "Jobs and tasks that would generate beryllium exposure (demolition, repair, clean up, abrasive blasting, welding, cleaning and grinding of beryllium containing tools, etc.) may only be done periodically and

meeting the “30 days over the action level” in order to qualify for medical surveillance may not be easy to quantify or may require extensive recordkeeping as workers move from job to job or contract to contract. Therefore, any exposures above the PEL should trigger the medical surveillance and hazard communication provisions.” (Document ID 2211, p. 11). Lisa Barker from NJH further testified that persons who are genetically susceptible can become sensitized from limited exposures (Document ID 2222, Tr. 56-57).

As explained in the Summary and Explanation for paragraph (g), OSHA is not reinstating a definition for emergency, and readers should refer to that section for a complete explanation. In response to NABTU’s comment that emergency exposures should be included in medical and work histories, OSHA does not specify the individual questions to include in a medical and work history. Instead, OSHA simply requires that medical and work histories include “past and present exposure to beryllium.” An unexpected exposure, such as would occur with a containment failure, would therefore be included in the medical and work history for an employee who undergoes medical surveillance under the beryllium standard. In addition, paragraph (k)(4)(i) requires the employer to inform the PLHCP about former and current levels of airborne exposure. OSHA would expect the employer to inform the PLHCP if the employee experienced an incident where he or she was exposed to levels of beryllium that exceeded the employee’s typical exposure levels.

In response to NJH’s suggestion that, if the emergency provision is removed, OSHA should require medical surveillance for any exposure above the PEL, OSHA notes that NJH’s position is not limited to exposures in an emergency but to any exposures any exposures above the PEL that occur for fewer than 30 days. In other words, NJH asks OSHA to reconsider the appropriateness of the 30-day exposure-duration trigger generally. OSHA evaluated the

appropriateness of the 30-day trigger in the 2017 final rule. At that time, NJH and other stakeholders opposed the 30-day exposure-duration trigger for medical surveillance. After careful consideration of comments and other evidence in the record, OSHA decided to maintain the 30-day exposure-duration trigger because it is consistent with the agency's risk assessment showing increasing risk of health effects from exposure at increasing cumulative exposures, which considers both exposure level and duration (82 FR at 2528-40, 2698). OSHA found a 30-day trigger to be a reasonable benchmark for capturing increasing risk from cumulative effects caused by repeated exposures. Between that rulemaking and the present, OSHA has not received any additional evidence demonstrating that this benchmark is inappropriate. Finally, OSHA notes that the 30-day exposure-duration trigger is consistent with the general industry beryllium standard and other OSHA health standards, such as the standards for chromium (VI) (29 CFR 1910.1026), cadmium (29 CFR 1910.1027), lead (29 CFR 1910.1025), asbestos (29 CFR 1910.1001), and respirable crystalline silica (29 CFR 1910.1053) (82 FR at 2698).

With respect to NJH's related concern regarding the tracking of exposures in the construction industry -- where tasks may be performed intermittently at different locations -- similar concerns were raised during the respirable crystalline silica rulemaking. In that rulemaking, OSHA acknowledged that tracking exposures in construction can be challenging. However, it pointed to evidence in the record showing that some construction employers were able to determine which employees were exposed above the PEL based on employee schedules and task-based hazard assessments. (81 FR 16285, 16815-16 (March 25, 2016)). Indeed, an employer can determine eligibility for medical surveillance based on information from exposure assessments for the various tasks and knowledge about how often the task is performed. Compliance officers can also determine if employees who were exposed at or above the action

level for 30 or more days a year were not offered medical surveillance by questioning employees about how often they perform certain tasks. As such, OSHA finds it is possible to quantify exposure for employees that are only periodically exposed to beryllium without extensive recordkeeping. Accordingly, OSHA believes it is appropriate to maintain the 30-day trigger and that this will not create undue burdens with respect to recordkeeping.

Moreover, employees experiencing signs or symptoms or other beryllium-related health effects after intermittent or unexpected exposures to beryllium can ask for an examination under paragraph (k)(1)(i)(B). Paragraph (m)(2)(i)(A) requires the employer to provide information and training in accordance with the Hazard Communication Standard (HCS), 29 CFR 1910.1200(h), for each employee who has, or can reasonably be expected to have, airborne exposure to beryllium. Paragraph (m)(2)(ii) also requires employers to ensure that these employees can demonstrate knowledge and understanding of a number of specified topics, including the signs and symptoms of CBD. Thus, employees who are intermittently exposed should possess the knowledge necessary to determine whether they should request an examination. In summary, OSHA has determined that the evidence presented does not support reinstating triggers for an emergency exposure or reconsidering the 30-day exposure-duration as a trigger for medical surveillance.

The second set of changes that OSHA proposed were minor revisions to paragraphs (k)(3)(ii)(A) and (k)(4)(i). Paragraph (k)(3)(ii)(A) previously required the employer to ensure that the employee is offered a medical examination that includes a medical and work history, with an emphasis on, among other things, past and present airborne exposure to or dermal contact with beryllium. Paragraph (k)(4)(i) previously required the employer to ensure that the examining PLHCP (and the agreed upon CBD diagnostic center, if an evaluation is required

under paragraph (k)(7) of this standard) had certain information, including a description of the employee's former and current duties that relate to the employee's airborne exposure to and dermal contact with beryllium, if known. In the 2019 NPRM, OSHA proposed to clarify these provisions by replacing the phrase "airborne exposure to and dermal contact with beryllium" with the simpler phrase "exposure to beryllium" (84 FR at 53919). OSHA reasoned that employees with beryllium exposure of any kind should have access to records of their exposure, and this information should also be made available to an examining PLHCP and CBD diagnostic center, if applicable. OSHA intended for this proposed change to alleviate any unnecessary confusion created by the use of the term "dermal contact," which is defined in the general industry standard but not in the construction and shipyards standards.

AFL-CIO and NABTU commented on OSHA's proposed changes to paragraphs (k)(3) and (4). AFL-CIO opposed OSHA's proposed revision to paragraph (k)(4)(i), arguing that it is important for the physician to be informed about both airborne and dermal exposures and that removing that clarification would increase confusion by putting the burden on the employer and physician to understand OSHA's intent (Document ID 2210, p. 9). In further support of retaining provisions that provide protection from dermal exposure, AFL-CIO referenced a previous comment from NABTU stating that the skin should be examined because beryllium exposure can result in "skin irritation, skin bumps, and sores that won't heal." (Document ID 2244, pp. 8-9; 1679, Attachment A, p. 1). NABTU commented that OSHA should retain the "protections against airborne exposures" in paragraph (k)(3) (Document ID 2240, p. 6).

OSHA clarifies that it does not intend to change the requirements for the type of information provided to the physician, and if the employee does have the potential for dermal exposure, the employer is to provide that information to the physician. OSHA proposed this

change not to limit the type of information provided to physicians, but instead, to make clear that employers and employees should inform physicians about *any* type of beryllium exposure.

OSHA continues to believe that the change will reduce confusion by removing terminology—the reference to dermal contact—that is not used in the construction and shipyards standard. In addition, the requirement for the PLHCP to examine the skin for rashes is retained in paragraph (k)(3)(ii)(C). Consistent with the 2017 final rule, OSHA continues to believe that it is important to examine the skin for rashes because it could be a sign that dermal sensitization or exposures that put the employee at risk of sensitization have occurred (82 FR at 2471). OSHA disagrees with AFL-CIO that simplifying the language of these provisions will result in confusion, because the revised text clearly encompasses all exposure to beryllium. Accordingly, OSHA has decided to finalize the changes to paragraph (k)(3)(ii)(A) and (k)(4)(i) as proposed.

The final set of changes that OSHA proposed to the construction and shipyard standards' medical surveillance requirements is in paragraph (k)(7), which contains the requirements for an evaluation at a CBD diagnostic center. In this final rule, OSHA is amending paragraph (k)(7) in three ways. First, OSHA is revising paragraph (k)(7)(i) to require that the evaluation be scheduled within 30 days, and occur within a reasonable time, of the employer receiving one of the types of documentation listed in paragraph (k)(7)(i)(A) or (B). Second, OSHA is adding a provision in paragraph (k)(7)(ii), which clarifies that, as part of the evaluation at the CBD diagnostic center, the employer must ensure that the employee is offered any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. The new provision also states that if any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may

be performed at another location that is mutually agreed upon by the employer and the employee. Third, OSHA is making a number of minor, non-substantive revisions to the numbering and cross-references in paragraph (k)(7) to account for the addition of new paragraph (k)(7)(ii). Specifically, OSHA is renumbering current paragraphs (k)(7)(ii), (iii), (iv), and (v) as (k)(7)(iii), (iv), (v), and (vi), respectively, and is adding a reference to new paragraph (k)(7)(ii) to the newly renumbered paragraph (k)(7)(vi). These proposed changes are consistent with changes the agency proposed to paragraph (k)(7)(i) of the beryllium standard for general industry in December 2018.

Each of these final revisions differ in some way from the proposed amendments based on stakeholder feedback. With regard to the first change concerning the timing of the exam, the previous standard required employers to provide the examination within 30 days of the employer receiving one of the types of documentation listed in paragraph (k)(7)(i)(A) or (B). The purpose of the 30-day requirement was to ensure that employees receive the examination in a timely manner. However, since the publication of the 2017 final rule, stakeholders have raised concerns that it is not always possible to schedule and complete the examination and any required tests within 30 days (84 FR at 53919).

To address this concern, OSHA proposed that the employer provide an initial consultation with the CBD diagnostic center, which could occur via telephone or virtual conferencing methods, rather than the full evaluation, within 30 days of the employer receiving one of the types of documentation listed in paragraph (k)(7)(i)(A) or (B). OSHA explained that providing a consultation before the full examination at the CBD diagnostic center would demonstrate that the employer made an effort to begin the process for a medical examination. OSHA also noted that the proposed change would also (1) allow the employee to consult with a

physician to discuss concerns and ask questions while waiting for a medical examination, and (2) allow the physician to explain the types of tests that are recommended based on medical findings about the employee and explain the risks and benefits of undergoing such testing. In both the 2019 NPRM for construction and shipyards (84 FR at 53919) and the 2018 NPRM for general industry (83 FR at 63758), OSHA requested comments on the appropriateness of providing the initial consultation within 30 days and on the sufficiency of a consultation via telephone or virtual conference.

OSHA received several comments on the proposed changes from NJH, AFL-CIO, and Materion. NJH commented that an examination at the CBD diagnostic center should not be required to occur within 30 days of the referral because openings at clinics may not be available within a 30-day period (Document ID 2211, p. 12). NJH further noted that “[i]t is common practice in most diagnostic centers to schedule specialty exams within a 3-month window due to the need to coordinate worker time away from work and home, physician visits, pulmonary function testing, chest imaging, bronchoscopy and other testing for one clinical evaluation visit” (Document ID 2211, p. 12). At the public hearing, NJH testified that an evaluation can take up to three days when an employee undergoes procedures such as bronchoscopy because the employee has to be cleared for testing, undergo testing on the following day, and then spend the night locally to ensure there are no adverse effects before discharge (Document ID 2222, Tr. 54).³⁵

³⁵ In response to the 2018 NPRM for general industry, OSHA received similar comments on the proposed timeline for the evaluation at the CBD Diagnostic Center from ATS, NJH, and Materion (Document ID OSHA-2018-0003-0021, p. 3; OSHA-2018-0003-0022, pp. 5-6; OSHA-2018-0003-0038, p. 34). DOD recommended that the evaluation at the CBD Diagnostic center be scheduled within seven days (Document ID OSHA-2018-0003-0029, p. 2), but OSHA found that this would not give employees enough time to consider obligations and have discussions with family members. The agency also found the 30-day trigger to be administratively convenient because it is consistent with other triggers in the beryllium standard (85 FR 42621).

NJH also opposed the proposed requirement for a consultation that can be performed via telephone or virtual conferencing within 30 days of the employer receiving documentation recommending a referral. NJH commented: “A video or phone consultation adds cost and logistics to scheduling and is not necessary as the PLHCP who sees the employee for screening provides information on the clinical evaluation. HIPAA privacy issues of a phone or video conference also exist. A full clinical evaluation including review of both the available medical and exposure data and hands-on medical assessment are essential to providing the best, most efficient care—from a time and financial perspective.” (Document ID 2211, pp. 12-13.)

Lisa Barker from NJH further testified that workers who are sensitized but feel well may decide to forgo additional testing following a video consultation (Document ID 2222, Tr. 54-55). These workers would miss the opportunity to determine if they have the disease, and if so, receive treatments to slow progression upon initial confirmation of sensitization (Document ID 2222, Tr. 54-55). NJH also expressed concerns related to the expertise and availability of a PLHCP who might perform the consultation and about workers who may not have a health care provider to facilitate a phone or video consultation (Document ID 2243, p. 6).

NJH recommended that the employer be required to schedule the appointment within 30 days, but that the actual evaluation can take place beyond 30 days of the confirmed abnormal result (Document ID 2211, p. 13). AFL-CIO agreed with NJH on the proposed timeline for an evaluation at a CBD diagnostic center (Document ID 2210, p. 9). Materion agreed with NJH that an evaluation at the CBD diagnostic center should be scheduled within 30 days after sensitization

is confirmed and documented; however, it noted that employees can withhold test results from employers (Document ID 2237, p. 5).³⁶

After considering these comments, OSHA is convinced that scheduling a phone or virtual consultation with the CBD diagnostic center is an unnecessary step that adds logistical complications and costs. OSHA finds that the scheduling approach suggested by NJH addresses both the logistical difficulties and the timing concerns with respect to the requirements in the current standard. Moreover, OSHA finds that employees will have enough information (through trainings under paragraph (m) and discussions with the PLHCP) to allow them to decide whether to choose to be evaluated at the CBD diagnostic center without the need for an additional consultation.³⁷ OSHA is therefore amending paragraph (k)(7)(i) to require that the employer schedule an examination at a CBD diagnostic center within 30 days of receiving one of the types of documentation listed in paragraph (k)(7)(i)(A) or (B). In response to Materion's concern that an employee can choose to withhold the recommendation for an evaluation at a CBD diagnostic center from the employer, the paragraph makes clear that the appointment must be scheduled within 30 days of the "employer's receipt" of the appropriate documentation. That means that the employer's obligations do not commence until the employer receives the documentation for an evaluation at a CBD diagnostic center following the employee's authorization.

To achieve the intent of the 2017 final rule and the 2019 NPRM that evaluation at a CBD diagnostic center occurs in a timely manner, OSHA is adding that the evaluation must occur

³⁶ In response to the NPRM for general industry, Materion found OSHA's proposed change for a consultation with a CBD diagnostic center more workable than an evaluation at a CBD Diagnostic Center within 30 days, but similar to the comments provided for this construction and shipyards NPRM, ATS and NJH disagreed with the requirement for a consultation (Document ID OSHA-2018-0003-0038, p. 34; OSHA-2018-0003-0021, p. 3; OSHA-2018-0003-0022, pp. 5-6).

³⁷ Under paragraph (k)(6)(i)(D), the employer is to ensure that the PLHCP explains the results of the medical examination to the employee, including results of tests conducted and medical conditions related to airborne beryllium exposure that require further evaluation or treatment.

within a reasonable time. Requiring that the evaluation occur within a reasonable time ensures that the evaluation be done as soon as practicable based upon availability of openings at the CBD diagnostic center and the employee's preferences. This revision better addresses OSHA's original intent that the employee be examined within a timely period, while providing employees and employers with maximum flexibility and convenience.

The second change that OSHA proposed to paragraph (k)(7)(i) relates to the contents of the examination at the CBD diagnostic center. As discussed in more detail above, the former definition of *CBD diagnostic center*—which stated that the evaluation at the diagnostic center “must include” a pulmonary function test as outlined by American Thoracic Society criteria, bronchoalveolar lavage (BAL), and transbronchial biopsy—could have been misinterpreted to mean that the examining physician was required to perform each of these tests during every clinical evaluation at a CBD diagnostic center. That was not OSHA's intent. Rather, the agency merely intended to ensure that any CBD diagnostic center has the capacity to perform any of these tests, which are commonly needed to diagnose CBD. Therefore, OSHA proposed revising the definition to clarify that the CBD diagnostic center must simply have the ability to perform each of these tests when deemed appropriate.

To account for that proposed change to the definition of *CBD diagnostic center* and to ensure that the employer provides those tests if deemed appropriate by the examining physician at the CBD diagnostic center, OSHA proposed expanding paragraph (k)(7)(i) to require that the employer provide, at no cost to the employee and within a reasonable time after consultation with the CBD diagnostic center, any of the three tests mentioned above, if deemed appropriate by the examining physician at the CBD diagnostic center (84 FR at 53919). OSHA explained that the revision would also clarify the agency's original intent that, instead of requiring all three

tests to be conducted after referral to a CBD diagnostic center, the standard would allow the examining physician at the CBD diagnostic center the discretion to select one or more of those tests as appropriate (84 FR at 53919).

OSHA received comments addressing the types of tests that should be conducted for the evaluation of CBD. NJH commented that at a minimum, a clinical evaluation for CBD should include “full pulmonary function testing (including lung volumes, spirometry and diffusion capacity for carbon monoxide) and chest imaging” (Document ID 2211, p. 4); that the examination should include “bronchoalveolar lavage and biopsy, whether or not a person shows signs or symptoms of frank, chronic beryllium disease” (Document ID 2222, Tr. 56); and that “the services should be available at the center” (Document ID 2211, p. 12). NJH recommended that OSHA follow the American Thoracic Society guidelines recommending that beryllium sensitized individuals undergo “[Pulmonary function testing] and chest imaging (either a chest radiograph or chest CT [computerized tomography] scan,” with consideration of bronchoscopy, depending on “absence of contraindications, evidence of pulmonary function abnormalities, evidence of abnormalities on chest imaging, and personal preference of the patient” (Document ID 2211, pp. 2, 4, 12). Similarly, NABTU submitted a description of the Building Trades National Medical Screening Program recommending that sensitized persons without clinical signs of CBD undergo pulmonary function testing and a high resolution chest CT, with lavage or biopsy only if the pulmonary function tests or CT scans suggest CBD or if the patient prefers to undergo lavage or biopsy (Document ID 2202, Attachment 4, PDF page 97). Lisa Barker from NJH testified that if OSHA does not specify such tests, medical directors may not order some

tests because of a lack of education or information or because the worker feels well and is not interested in an evaluation (Document ID 2222, Tr. 66-68).³⁸

After reviewing these comments and the remainder of the record on this issue, OSHA remains convinced that pulmonary function testing, BAL, and transbronchial biopsies are important diagnostic tools but finds that the examining physician at the CBD diagnostic center is in the best position to determine which diagnostic tests are appropriate for particular workers. The agency believes that the modified definition of the term *CBD diagnostic center*, which requires the centers to have the capacity to perform these three tests, will serve to ensure that healthcare providers at the centers are aware of the importance of and are able to perform these tests.

However, OSHA understands that the proposed provision could be misinterpreted to mean that the employer does not have to make available additional tests that the examining physician deems appropriate for reasons such as diagnosing or determining the severity of CBD. That was never the agency's intent. In fact, OSHA noted the potential for other tests, as deemed necessary by the CBD diagnostic center physician, at several points in the preamble to the 2017 final rule (see, e.g., 82 FR at 2709, 2714). Similar to paragraph (k)(3)(ii)(G), which provides that the employer must ensure that the employee is offered as part of the initial or periodic medical examination any test deemed appropriate by the PLHCP, OSHA intends for the employer to ensure the employee is offered any tests deemed appropriate by the examining physician at the CBD diagnostic center, including tests for diagnosing CBD, for determining its severity, and for monitoring progression of CBD following diagnosis. Allowing the physician at the CBD

³⁸ Similar comments regarding the need for certain tests to diagnose CBD were submitted in response to the general industry NPRM by ATS, NJH, and AOEC (Document ID OSHA-2018-0003-0021, p. 3; OSHA-2018-0003-0022, p. 3; OSHA-2018-0003-0028, p. 2).

diagnostic center to order additional tests that are deemed appropriate is also consistent with most OSHA substance-specific standards, such as respirable crystalline silica (29 CFR 1910.1053) and chromium (VI) (29 CFR 1910.1026).

To clarify the agency's intent that the physician at the CBD diagnostic center has discretion to order appropriate tests, and to further respond to stakeholder concerns regarding the necessity of pulmonary function testing, BAL, and transbronchial biopsies, OSHA is adding a new paragraph (k)(7)(ii), which focuses on the content of the examination. This new provision requires that the evaluation include any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the ATS criteria), BAL, and transbronchial biopsy. OSHA intends for the new provision to make clear that the employer must provide additional tests, such as those recommended by NJH, ATS guidelines, and by Building Trades National Medical Screening Program, at no cost to the employee, if those tests are deemed necessary by the examining physician. The agency also believes that explicitly naming the three examples of tests that may be appropriate will further emphasize their importance to examining physicians at the CBD diagnostic centers.

Consistent with OSHA's original intent, those tests are only required to be offered if deemed appropriate by the physician at the CBD diagnostic center. For example, if lung volume and diffusion tests were performed according to ATS criteria as part of the periodic medical examination under paragraph (k)(3), and the physician at the CBD diagnostic center found them to be of acceptable quality, those tests would not have to be repeated as part of a CBD evaluation. The addition of paragraph (k)(7)(ii) clarifies that the employer must, however, offer any test that the PLHCP deems appropriate. Consistent with previous health standards and the meaning of the identical phrase in paragraph (k)(3)(ii)(G), OSHA intends the phrase "deemed

appropriate’’ to mean that additional tests requested by the physician must be both related to beryllium exposure and medically necessary, based on the findings of the medical examination (see 82 FR at 2709; Occupational Exposure to Respirable Crystalline Silica, 81 FR 16286, 16514 (March 25, 2016)). Because of the technical expertise that a facility must have in order to meet the definition of a CBD diagnostic center, OSHA is also confident that physicians at those facilities will have the expertise to identify additional tests that may be useful to diagnose or assess the severity of CBD.

New paragraph (k)(7)(ii) also addresses the possibility that a test that is deemed appropriate by the examining physician at the CBD diagnostic center might not be available at that center. Although OSHA’s intention has been to require any testing to be provided by the same CBD diagnostic center unless the employer and employee agree to a different CBD diagnostic center (see 83 FR at 63758), there may be cases where the CBD diagnostic center does not perform a type of test deemed appropriate by the examining physician. In such a case, OSHA wants to ensure that the employee can receive the appropriate test. Therefore, OSHA is also including in paragraph (k)(7)(ii) a requirement that if any of those tests deemed appropriate by the physician are not available at the CBD diagnostic center, they may be performed at another location that is mutually agreed upon by the employer and the employee. This other location does not need to be a CBD diagnostic center as long as it is able to perform tests according to requirements under paragraph (k).

In summary, final paragraph (k)(7)(i) requires that the employer provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed to by the employer and the employee. The evaluation must be scheduled within 30 days and must occur within a reasonable time of the employer receiving one of the types of documentation listed in paragraph

(k)(7)(i)(A) or (B). Final paragraph (k)(7)(ii) requires that the evaluation include any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the ATS criteria), BAL, and transbronchial biopsy. Paragraph (k)(7)(ii) further requires that if any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may be performed at another location that is agreed upon by the employer and employee and at no cost to the employee.³⁹

Paragraph (m) Communication of Hazards

Paragraph (m) of the beryllium standards for construction and shipyards sets forth the employer's obligations to comply with OSHA's Hazard Communication Standard (HCS) (29 CFR 1910.1200) relative to beryllium, and to take additional steps to warn and train employees about the hazards of beryllium. Under the HCS, beryllium manufacturers and importers are required to evaluate the hazards of beryllium and prepare labels and safety data sheets (SDSs) and provide both documents to downstream users. Employers whose employees are exposed to beryllium in their workplace must develop a hazard communication program and ensure that employees are trained on the hazards of beryllium. These employers must also ensure that all containers of beryllium are labeled and that employees are provided access to the SDSs. In addition to the requirements under the HCS, paragraph (m)(1)(ii) of the beryllium standards specify certain criteria that must be addressed in classifying the hazards of beryllium. In the standard for shipyards, paragraph (m)(2) requires employers to provide and display warning

³⁹ OSHA is also making a number of minor, non-substantive revisions to the numbering and cross-references in paragraph (k)(7) to account for the addition of new paragraph (k)(7)(ii). Specifically, OSHA is renumbering current paragraphs (k)(7)(ii)-(v) as (k)(7)(iii), (iv), (v), and (vi), and is adding a reference to new paragraph (k)(7)(ii) to the newly renumbered paragraph (k)(7)(vi).

The addition of paragraph (k)(7)(ii) and consequential renumbering of current paragraphs (k)(7)(ii)-(v) also affects two other cross-references in the standard. Paragraphs (l)(1)(i)(B) and (l)(1)(ii) reference paragraphs (k)(7)(ii) and (k)(7)(iii), respectively. In this final rule, OSHA is updating those references to reflect the renumbering in paragraph (k)(7).

signs with specified wording at each approach to a regulated area. Paragraph (m)(3) of the shipyards standard, and paragraph (m)(2) of the construction standard, details employers' duties to provide information and training to employees.

In the 2019 NPRM, OSHA proposed three changes to paragraph (m) of the construction and shipyard standards to align with proposed changes to other provisions in these standards. First, OSHA proposed to remove the paragraph (m) provisions that require specific language for warning labels applied to bags and containers of clothing, equipment, and materials contaminated with beryllium (paragraph (m)(2) in construction and paragraph (m)(3) in shipyards).⁴⁰ This is consistent with OSHA's proposal to remove the corresponding requirements to provide such warning labels from paragraphs (h)(2)(v) and (j)(3). As explained in the 2019 NPRM, and earlier in this Summary and Explanation with regard to paragraphs (h)(2)(v) and (j)(3), OSHA proposed to remove the requirements in both standards to label PPE removed from the workplace for laundering, cleaning, maintenance, or disposal and to label beryllium-containing material destined for disposal in accordance with the labeling requirements in paragraph (m) of the 2017 final rule. The agency proposed these changes to reflect its intent that provisions aimed at protecting workers from the effects of dermal contact need not apply to materials containing only trace amounts of beryllium—like all beryllium-containing material used in abrasive blasting in the construction and shipyards industries—in the absence of significant airborne exposure. OSHA applied the same rationale to the limited welding operations in shipyards, where the agency had evidence that at most only trace amounts of particulate beryllium will form (84 FR at 53906); see also the Summary and Explanation for

⁴⁰ As a result, OSHA proposed to renumber paragraph (m)(4) in the shipyards standard (29 CFR 1915.1024) as (m)(3), renumber paragraph (m)(3) in the construction standard (29 CFR 1926.1124) as (m)(2), and revise the references in paragraph (m)(1)(ii) of both standards accordingly.

paragraphs (h) and (j). Accordingly, the agency preliminarily determined that labels are not necessary to protect employees in the context of trace beryllium in construction and shipyards, and, therefore, the provisions of paragraph (m) mandating specific language for such labels are likewise unnecessary.

National Jewish Health (NJH) objected to OSHA's proposal, stating that all PPE and waste that is contaminated with or contains beryllium should be labeled as such. "It is not always the case that the contamination contains only trace amounts of beryllium. . . . It cannot be overlooked that workers in the construction industries may be involved in demolition and disassembly of beryllium contaminated buildings, machines and materials" (Document ID 2211, p. 13). NJH further noted that DOE beryllium training materials state, "Laundry workers and personnel who are responsible for the cleaning and maintenance of respirators have a high potential for being exposed to airborne beryllium dust" (Document ID 2211, p. 13; COMMUNICATING HEALTH RISKS WORKING SAFELY WITH BERYLLIUM: Training Reference for Beryllium Workers and Managers/Supervisors Facilitator Manual, Beryllium Health Risk Communication Task Force, DOE, April 2002, https://www.energy.gov/sites/prod/files/2014/09/f18/communicating_0.pdf). AFL-CIO similarly expressed concern that without the labeling requirements of the 2017 standard, downstream recipients of contaminated PPE and scrap materials generated during renovation or demolition of beryllium manufacturing sites would not be informed of the potential for airborne beryllium exposure for workers handling these items (Document ID 2210, pp. 8-9; 2222, pp. 118-19).

AFL-CIO also raised concerns about the removal of labeling requirements for construction materials that are contaminated with beryllium that are dumped in landfills (Document ID 2244, pp. 3-4). AFL-CIO indicated that landfill workers are at risk of exposure to

airborne dust that may be created by their work activities. Without label information on beryllium-containing waste materials sent from construction activities, they argue, landfill workers may not don appropriate PPE to protect themselves from beryllium exposure while performing their work duties. In their comments, NABTU also included landfill employees as a group of workers with potential beryllium exposure from construction activities (Document ID 2202, p. 4).

OSHA has no evidence that laundry or landfill workers who handle PPE or materials designated for disposal from construction sites or shipyards would engage in tasks that generate airborne exposure of concern. First, the agency believes that NJH's reliance on DOE's 2002 instruction manual is misplaced. The manual is directed specifically to DOE facilities; facilities that processed materials containing beryllium in more than trace quantities. In fact, for purposes of DOE's own beryllium regulations, the agency defines *beryllium* as any insoluble beryllium compound or alloy *containing 0.1 percent beryllium or greater* that may be released as an airborne particulate (10 CFR 850.3). The DOE manual is therefore not relevant to the construction and shipyards context.

Furthermore, evidence in the record demonstrates that, with respect to materials containing only trace quantities of beryllium, airborne dust concentrations must be very high for exposures to approach even the action level (AL). For dust containing less than 4 ppm beryllium, airborne dust concentrations would have to exceed 25 mg/m³ to reach the beryllium AL of 0.1 µg/m³. This level of dust would significantly exceed the OSHA PEL for nuisance dust, or Particulate Not Otherwise Classified (PNOC), of 15mg/m³ (see Document ID 2235, p. 2; FEA for the 2017 Final Rule, Chapter IV, p. IV-640). OSHA has no reason to suspect that residual dust on PPE and other materials from construction and shipyards sites is likely to create this level

of airborne dust from laundry or landfill operations. Therefore, the agency has determined that recipients of PPE or waste from these worksites are not expected to be exposed at airborne levels of concern from re-entrainment of trace beryllium from these materials. And, as explained previously, provisions aimed at protecting workers from the effects of dermal contact need not apply to materials containing only trace amounts of beryllium unless those workers are also exposed to significant airborne beryllium.

OSHA has retained certain provisions that protect construction and shipyard employees whose work activities involve exposures exceeding the PEL, such as abrasive blasters, from further airborne exposure via re-entrainment of beryllium-containing dust from PPE or other surfaces in the workplace. These include requiring the employer to ensure that each employee removes personal protective clothing and equipment required by this standard at the end of the work shift or at the completion of all tasks involving beryllium, whichever comes first (paragraph (h)(2)(i)); requiring the employer to ensure that personal protective clothing and equipment required by this standard is not removed in a manner that disperses beryllium into the air (paragraph (h)(2)(ii)); requiring the employer to ensure that all reusable personal protective clothing and equipment required by this standard is cleaned, laundered, repaired, and replaced as needed to maintain its effectiveness (paragraph (h)(3)(i)); requiring the employer to ensure that beryllium is not removed from personal protective clothing and equipment required by this standard by blowing, shaking or any other means that disperses beryllium into the air (paragraph (h)(3)(ii)); and requiring the employer to include procedures for removing, cleaning, and maintaining personal protective clothing and equipment in accordance with paragraph (h) of this standard in their written exposure control plan(s) (paragraph (f)(1)(i)(F)).

OSHA proposed to remove those provisions which would apply only to employees whose work activities do not involve airborne exposure above the PEL, for whom potential exposure to re-entrained beryllium from materials containing trace amounts is not a significant concern. As OSHA explained in the Summary and Explanation for paragraphs (h)(2)(v) and (j)(3), this approach is consistent with the general industry standard as modified by the DFR, which does not require labeling for materials that contain only trace quantities of beryllium and are designated for disposal, recycling, or reuse.

In the case where construction workers are removing materials from a beryllium manufacturing site covered by the general industry standard, beryllium-contaminated materials destined for disposal must be cleaned and labeled by the host employer pursuant to paragraph (j)(3) of the beryllium standard for general industry. Indeed, even without the specific requirement in the beryllium standard, OSHA has had a long-standing interpretation that the HCS requires upstream suppliers to pass on any information they have regarding known contaminants of scrap transferred to downstream recipients (see Letter to Edward L. Merrigan, from John Miles, Jr., Directorate of Field Operations (May 23, 1986), available at <https://www.osha.gov/laws-regs/standardinterpretations/1986-05-23>).

Finally, AFL-CIO quoted a comment previously submitted by Washington Group International (WGI) (see Document ID 0324) which includes the proposition that “it is crucial that government/industrial buildings be screened for beryllium process operations” and appears to suggest that, similar to DOE facilities, all facilities should do air monitoring and wipe sampling and pass this information on to future facility users (Document ID 2244, p. 4). It is unclear whether AFL-CIO intended their presentation of WGI’s quote to suggest that all government and industrial buildings should air-monitor and sample surfaces for the presence of

beryllium. OSHA believes that this approach may be appropriate for DOE, which has a limited number of sites that are known to have processed beryllium. However, requiring all government and industrial sites to do air monitoring and wipe sampling would be of little value since the likelihood of finding beryllium would be minuscule. Beryllium, unlike lead and asbestos, is not found in common building materials or coatings (see Document ID 2237, pp. 2-3). Therefore unless a manufacturing site has evidence that beryllium is present through the review of SDSs, the likelihood that workers will encounter materials contaminated with beryllium is low. And, as noted above, where construction workers are removing materials from a beryllium manufacturing site covered by the general industry standard, beryllium-contaminated materials destined for disposal must be cleaned and labeled by the host employer pursuant to paragraph (j)(3) of the beryllium standard for general industry.

Accordingly, OSHA has determined that the previous labeling provisions in paragraph (m) (paragraph (m)(2) in construction and (m)(3) in shipyards) are not necessary in the construction and shipyards contexts and is finalizing the removal of these provisions as proposed.

OSHA next proposed to revise the provisions of paragraph (m) for employee information and training to remove requirements related to emergency procedures ((m)(3)(ii)(D) in construction and (m)(4)(ii)(D) in shipyards)⁴¹ and personal hygiene practices ((m)(3)(ii)(E) in construction and (m)(4)(ii)(E) in shipyards). These proposed revisions correspond with OSHA's proposed removal of emergency procedures and personal hygiene practices from the construction and shipyard standards. As discussed in the 2019 NPRM and earlier in this Summary and Explanation, OSHA proposed to remove references to emergencies in the shipyards and

⁴¹ OSHA proposed to renumber the provisions of paragraph (m)(3)(ii) in construction and (m)(4)(ii) in shipyards to reflect the removal of this paragraph.

construction standards because OSHA expects that any emergency in these industries (such as a release resulting from a failure of the blasting control equipment, a spill of the abrasive blasting media, or the failure of the ventilation system for welding operations in shipyards) would occur only during the performance of routine tasks already associated with the airborne release of beryllium; i.e., during the abrasive blasting or welding process (84 FR at 53917; see also the Summary and Explanation for paragraph (g)). As such, any uncontrolled release of beryllium in these operations would not create exposures that differ from the normal conditions of work and workers will already be protected by the other provisions of paragraph (g). OSHA also proposed to remove the hygiene provisions of the construction and shipyard standards due to overlap with existing OSHA standards, the limited operations where beryllium exposure may occur in construction and shipyards, and the trace quantities of beryllium present in these operations (84 FR at 53920; see also the Summary and Explanation for paragraph (i)). As with the previously discussed labeling requirement, OSHA reasoned that the removal of these provisions would render the correlating training requirements unnecessary.

In response to OSHA's proposal to remove the hygiene provisions and related training requirements from both standards in favor of OSHA's general sanitation standards, NJH stated that "beryllium exposure poses a unique hazard for workers." As such, NJH argued that employees should continue to be trained on beryllium-specific hygiene practices (Document ID 2211, p. 13). AFL-CIO objected to the removal of requirements on training for both emergency and hygiene provisions, though they did not provide any additional explanation of their opposition (Document ID 2210, p. 10). As stated above, OSHA proposed to remove the training requirements related to emergencies and hygiene areas and practices from paragraph (m) because the agency proposed to remove the underlying requirements from the regulatory text.

With respect to emergencies, OSHA has determined that the operations with known beryllium exposure in the construction and shipyards sectors do not have emergencies in which exposures differ from the normal conditions of work. As such, workers in these operations are already protected by other provisions of the beryllium standards and emergency-specific provisions are not necessary (see the Summary and Explanation for paragraph (g)). OSHA has also determined that partial overlap between the hygiene requirements of the beryllium standards for construction and shipyards and those of existing OSHA standards, combined with the trace quantities of beryllium present in these industries, make beryllium-specific hygiene requirements unnecessary in the construction and shipyards standards (see the Summary and Explanation for paragraph (i)). OSHA is finalizing the regulatory text as proposed for these provisions. In light of OSHA's decision to remove these requirements, OSHA finds that it is unnecessary to maintain the beryllium-specific training requirements for these provisions. Accordingly, OSHA is finalizing the removal of training provisions on emergency procedures ((m)(3)(ii)(D) in construction and (m)(4)(ii)(D) in shipyards) and hygiene areas and practices ((m)(3)(ii)(E) in construction and (m)(4)(ii)(E) in shipyards), as proposed.

OSHA also proposed to revise paragraphs (m)(3)(i) in construction and (m)(4)(i) in shipyards—renumbered in the final standards as (m)(2)(i) and (m)(3)(i), respectively—to remove dermal contact as a trigger for training. The 2017 final standards for general industry, construction, and shipyards originally provided for limited training for each employee who has, or can reasonably be expected to have, airborne exposure to or dermal contact with beryllium. Specifically, paragraph (m)(3)(i)(A) in construction and (m)(4)(i)(A) in shipyards provided for training for each such employee in accordance with the requirements of the HCS (29 CFR 1910.1200(h)), including specific information on beryllium as well as any other hazards

addressed in the workplace hazard communication program.⁴² However, in the 2017 final rule, OSHA recognized that beryllium exposure in the construction and shipyard industries is narrowly limited to trace quantities contained in certain abrasive blasting media and to exposure during some welding operations in shipyards (82 FR at 2690; see also the 2017 FEA, Document ID 2042, p. III-66). OSHA clarified in the 2018 DFR for general industry that it did not intend for provisions aimed at protecting workers from the effects of dermal contact to apply in the case of materials containing only trace amounts of beryllium (83 FR at 19938). Therefore, OSHA preliminarily determined in the 2019 NPRM for construction and shipyards that training in accordance with the HCS should be provided to each employee who has, or can reasonably be expected to have, airborne exposure to beryllium, without regard to dermal contact. OSHA noted that both standards already exempt materials containing less than 0.1 percent beryllium by weight where the employer has objective data demonstrating that employee exposure to beryllium will remain below the action level as an 8-hour TWA under any foreseeable conditions (See 29 CFR 1926.1124(a)(3) (construction) and 29 CFR 1915.1024(a)(3) (shipyards)). OSHA reasoned that the HCS training requirements in proposed paragraph (m)(2) for construction and proposed paragraph (m)(3) for shipyards would continue to apply to all workers that are covered under these standards, regardless of the potential for dermal contact (84 FR at 53920-21). OSHA did not receive any comments on the removal of dermal contact as a trigger for training in accordance with the HCS and is therefore finalizing it as proposed.

OSHA also proposed to revise renumbered paragraphs (m)(2)(ii)(A) in the construction standard and (m)(3)(ii)(A) in the shipyards standard to remove references to “airborne exposure”

⁴² Paragraph (m)(3)(ii) in the 2017 construction standard and paragraph (m)(4)(ii) in the 2017 shipyard standard required the employer to ensure that each employee who is or can reasonably be expected to be exposed to airborne beryllium can demonstrate knowledge of all nine enumerated categories of information.

and “dermal contact” and instead to require training on the health hazards associated with “exposure to beryllium.” OSHA likewise proposed to revise renumbered paragraphs (m)(2)(ii)(D) in the construction standard and (m)(3)(ii)(D) in the shipyards standard to require training on measures employees can take to protect themselves from “exposure to beryllium.” These revisions, OSHA explained, would maintain OSHA’s intent that training must cover both airborne and skin exposure while both resolving an inconsistency between the shipyards and construction standards with respect to references to dermal contact and simplifying the provisions (84 FR at 53921).

AFL-CIO commented that “OSHA should not alter the requirement for employers to train workers on the health hazards associated with airborne and dermal exposure to beryllium.” According to the AFL-CIO, it is important for a worker to be provided with all potential exposure scenarios, including airborne and dermal exposures, so they can understand the full risk of exposure (Document ID 2210, p. 10). As the agency emphasized in the 2019 NPRM, the phrase “exposure to beryllium” is intended to encompass both airborne and skin exposure to beryllium (84 FR at 53921). Thus, the proposed language maintains the requirement to train workers on both airborne and dermal exposures. By resolving an inconsistency in the previous standards regarding dermal contact, OSHA intends the proposed change to ensure that employers include dermal contact when training workers on the specific hazards of beryllium.

In previously submitted comments, NABTU has expressed concern that they do not see a high level of awareness about hazards related to beryllium among workers in the construction industry apart from abrasive blasters and contract workers for DOE, citing a survey the union performed with trainers in the construction industry (Document ID 2202, Attachment 1, p. 8). OSHA believes that a few factors could explain this lack of awareness outside DOE and abrasive

blasting. First, as explained earlier in this preamble, abrasive blasting is the primary source of exposure in the construction industry and even the agency has been unable to obtain reliable data about any additional sources of exposure in the construction industry. This suggests that exposures in other contexts, if they occur, are rare (see the summary and explanation for paragraph (f)). Second, OSHA notes that while DOE has had a specific beryllium standard in place since 1999 (10 CFR part 850) due to the particular risks of exposure in its facilities, OSHA's comprehensive standards were only promulgated in 2017.

OSHA included hazard communication and training provisions in these standards specifically to ensure awareness in those industries covered by the standards. As employers implement the beryllium standards for general industry, construction, and shipyards, the agency expects this lack of awareness to dissipate. Furthermore, paragraph (e)(2) of the HCS (29 CFR 1910.1200) requires employers who produce, use, or store hazardous chemicals at a workplace to ensure that workers have access to safety data sheets and to inform workers of any precautionary measures needed during "normal operation conditions or foreseeable emergencies." These requirements of the HCS further serve to raise awareness among potentially exposed workers.

OSHA has considered the comments in the record and, for the reasons explained above, is finalizing the changes to paragraph (m) as proposed.⁴³

Paragraph (n) Recordkeeping

Paragraph (n) of the beryllium standards for construction and shipyards requires employers to make and maintain records of air monitoring data, objective data, medical surveillance, and training. It also requires employers to make all required records available to

⁴³ OSHA is also removing the heading "Employee Information" from paragraphs (m)(2)(iv) in the construction standard and (m)(3)(iv) in the shipyards standard to comply with the Federal Register's drafting rules. The requirements of these provisions are unchanged.

employees, their designated representatives, and the Assistant Secretary in accordance with OSHA's records access standard, 29 CFR 1910.1020. The 2017 final rule required employers to include employees' Social Security Numbers (SSNs) in air monitoring data ((n)(1)(ii)(F)), medical surveillance ((n)(3)(ii)(A)), and training ((n)(4)(i)) records. In the 2019 NPRM, OSHA proposed to revise paragraphs (n)(1)(ii)(F), (n)(3)(ii)(A), and (n)(4)(i) of both the construction and shipyards standards to remove those requirements (84 FR at 53921). This final rule adopts the proposed revisions, eliminating the requirements to include employee SSNs in monitoring data, medical surveillance, and training records.

In the 2015 beryllium NPRM which led to the 2017 final rule, OSHA proposed to require inclusion of employee SSNs in records related to air monitoring, medical surveillance, and training, as it had done in several existing substance-specific health standards (80 FR 47566, 47806 (August 7, 2015)). In their comments, some stakeholders objected to the proposed requirements based on concerns about employee privacy and the risk of identity theft (82 FR at 2730). In the 2017 final rule, OSHA acknowledged these concerns, but concluded that, due to the agency's past consistent practice of requiring an employee's SSN on records, any change to such requirements should be comprehensive and apply to all OSHA standards, not just the standards for beryllium (82 FR at 2730).

After OSHA published the 2015 beryllium proposal but before issuing the 2017 final beryllium rule, OSHA published its Standards Improvement Project-Phase IV (SIP-IV) proposed rule (81 FR 68504, 68526-28 (October 4, 2016)), in which the agency proposed to delete all requirements for employers to include employee SSNs in records required by the agency's substance-specific standards. Because the beryllium standards had not yet been finalized, they were not included in the SIP-IV proposal. Accordingly, the 2017 final rule for beryllium

included the SSN requirements. However, OSHA acknowledged in the preamble that the SIP-IV rulemaking was ongoing and stated that it would revisit its decision to require employers to include SSNs in beryllium records in light of the SIP-IV rulemaking, if appropriate (82 FR at 2730).

After promulgating the 2017 final rule, OSHA finalized Phase IV of its Standards Improvement Project (SIP-IV), which removed from OSHA standards all requirements for employee SSNs in employer records (84 FR 21416, 21439-40 (May 14, 2019)).⁴⁴ As OSHA explained in the SIP-IV final rule, removing requirements for SSNs results in additional flexibility for employers and allows employers to develop systems that best work for their unique situations (84 FR at 21440). OSHA also explained that the change would protect employee privacy and lower the risk of identity theft (84 FR at 21439-40). Consistent with the SIP-IV final rule, OSHA proposed in the 2019 NPRM to modify the beryllium standards for construction and shipyards by removing the requirements to include SSNs in the recordkeeping provisions in paragraphs (n)(1)(ii)(F) (air monitoring data), (n)(3)(ii)(A) (medical surveillance) and (n)(4)(i) (training) (84 FR at 53921).

Two commenters, the AFL-CIO (Document ID 2210, p. 10) and NJH (Document ID 2211, p. 14), expressed general support for the proposed removal of the requirements to include employees' SSNs in these three sets of records. No commenter opposed the proposed revisions. However, after stating their support for the change, NJH noted that "it is important that there is

⁴⁴ Eliminating requirements to include SSNs in records is also responsive to a directive from OMB that calls for federal agencies to identify and eliminate unnecessary collection and use of SSNs in agency systems and programs (See Memorandum from Clay Johnson III, Deputy Director for Management, Office of Management and Budget, to the Heads of Executive Departments and Agencies Regarding Safeguarding Against and Responding to the Breach of Personally Identifiable Information (M-07-16), May 22, 2007 (available at: <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2007/m07-16.pdf>).

an identifying link between exposure monitoring data and medical surveillance data in order to identify areas of increased risk” (Document ID 2211, p. 14).

OSHA acknowledges NJH’s concern but notes that the beryllium standards have never required employers to link their exposure monitoring to medical surveillance data in this way. Even so, employers remain free to utilize SSNs, or any other unique employee identifier, if doing so helps them to identify areas of increased risk. Regardless, the agency believes that areas of increased risk will be identifiable based on the medical surveillance records alone. Paragraph (k)(6) requires that, with the employee’s consent, the licensed physician’s written medical opinion for the employer must include the PLCHP’s recommendations regarding limitations on the employee’s airborne exposure to beryllium, referrals to a CBD Diagnostic Center, continued medical surveillance, and medical removal. This information will alert the employer to possible increased risk of exposure in the processes in which that employee works and the need to reevaluate these processes. It may also trigger the requirement in paragraph (f)(1)(ii) that the employer review and evaluate the effectiveness of its written exposure control plan. Therefore, OSHA has determined that the proposed revisions to paragraph (n) will not impair the identification of areas of increased risk within a worksite or facility.

NJH’s comment also touches on a related concern regarding the removal of requirements to record workers’ SSNs in exposure monitoring and medical records. As OSHA explained in the SIP-IV NPRM, the agency originally required the collection of employee SSNs in its standards because SSNs are assigned at birth and do not change over time. SSNs are therefore useful for research that tracks employees over time, as is done in some epidemiological studies of workplace populations (81 FR at 68527). While OSHA acknowledged the usefulness of SSNs for such research, the agency further noted that other tracking methods have emerged that allow

researchers to conduct these studies without the use of SSNs. OSHA stated that due to the seriousness of the threat of identity theft and the availability of other methods for tracking employees for research purposes, it was appropriate to reexamine the SSN collection requirements in its standards (81 FR at 68527). Weighing these considerations in the SIP-IV final rule, OSHA determined that it was appropriate to remove from OSHA standards all requirements for employee SSNs in employer records (84 FR at 21439-40). OSHA reaffirms its conclusions on this issue here.

Accordingly, OSHA is finalizing the proposed changes to paragraph (n) in this final rule, which will align the beryllium standards for construction and shipyards with OSHA's other substance-specific standards by removing the requirements to include employees' SSNs in air monitoring data ((n)(1)(ii)(F)), medical surveillance ((n)(3)(ii)(A)), and training ((n)(4)(i)) records. OSHA expects that compliance with paragraph (n) as revised will be straightforward for construction and shipyard employers who already comply with other OSHA standards that no longer contain requirements to include employee SSNs in records. Lastly, OSHA notes, as it did in the SIP-IV final rule, that by removing the requirements to include SSNs in records, OSHA is not requiring employers to delete SSNs from existing records or prohibiting employers from using SSNs in records if they wish to do so (see 84 FR at 21439-40).

IV. Final Economic Analysis

A. Introduction

This Final Economic Analysis (FEA) addresses issues related to the profile of affected application groups, establishments, and employees; and the cost savings and the benefits of OSHA's rule to modify several construction and shipyard ancillary provisions. This rule makes no changes to the 2017 final rule's TWA PEL and STEL for the shipyard and construction

industries. Relative to the estimated costs in the Final Economic Analysis (2017 FEA) in support of the January 9, 2017, beryllium final rule (Document ID 2042), this FEA would lead to total annualized cost savings of \$2.5 million in 2019 dollars at a 3 percent discount rate over 10 years; and total annualized cost savings of \$2.6 million in 2019 dollars at a discount rate of 7 percent over 10 years. When the Department uses a perpetual time horizon, the annualized cost savings of the rule would be \$2.3 million in 2016 dollars at a 7 percent discount rate.

The rule is not a “significant regulatory action” under Executive Order 12866 or the Unfunded Mandates Reform Act of 1995 (UMRA) (2 U.S.C. 1501 et seq.); nor is it a “major rule” under the Congressional Review Act (5 U.S.C. 801 et seq.). Neither the benefits nor the costs of this rule exceed \$100 million. In addition, they do not meet any of the other criteria specified by the UMRA for a significant regulatory action or the Congressional Review Act for a major rule.

This final rule makes several changes to the beryllium standards for construction and shipyards. These changes are designed to accomplish three goals: (1) to more appropriately tailor the requirements of the construction and shipyards standards to the particular exposures in these industries in light of partial overlap between the beryllium standards’ requirements and other OSHA standards; (2) to more closely align the shipyards and construction standards to the general industry beryllium standard with respect to the medical definitions and medical surveillance requirements, where appropriate; and (3) to clarify certain requirements with respect to materials containing only trace amounts of beryllium.

This FEA provides OSHA’s assessment of how this rule will affect the costs and benefits of complying with the beryllium standards for construction and shipyards, including costs adjustments to reflect changes in exposure rates and baseline compliance rates. All costs are

estimated in 2019 dollars. Costs reported in 2019 dollars were applied directly in this FEA; wage data were updated to 2019 dollars using BLS data (BLS, 2020a);⁴⁵ and all other costs reported for years earlier than 2019 were updated to 2019 dollars using the GDP implicit price deflator (BEA, 2020).⁴⁶

This introduction to the FEA is followed by:

- Section B: Profile of Affected Application Groups, Establishments, and Employees
- Section C: Technological Feasibility Summary
- Section D: Cost Savings
- Section E: Benefits

B. Profile of Affected Application Groups, Establishments, and Employees

Introduction

In this section, OSHA presents the profile of industries affected by this final rule. The profile data in this section are drawn from the industry profiles in Chapter III and exposure profiles and data in Chapter IV of the 2017 FEA (Document ID 2042); the PEA for the June 27, 2017 beryllium proposal (2017 PEA) (82 FR 29189-216); and the PEA for the October 8, 2019 beryllium proposal (2019 PEA) (82 FR at 53922-45). Much of the analysis here is unchanged from the 2019 PEA because, as will be explained below, the agency received no new information or data during the comment period that would alter the agency's analysis.

In the 2017 FEA, OSHA first identified the North American Industrial Classification System (NAICS) industries, both in the shipyard and construction sectors, with potential worker

⁴⁵ Bureau of Labor Statistics, Occupational Employment Statistics Survey – May 2019 (Released March 31, 2020) (Document ID 2248), available at <http://www.bls.gov/oes/tables.htm> (Accessed July 9, 2020) (BLS, 2020a).

⁴⁶ Bureau of Economic Analysis, Table 1.1.9. Implicit Price Deflators for Gross Domestic Product (Document ID 2246), available at https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&nipa_table_list=13 (Accessed July 9, 2020) (BEA, 2020).

exposure to beryllium. Next, OSHA provided statistical information on the affected industries, including the number of affected entities and establishments, the number of workers whose exposure to beryllium could result in disease or death (“at-risk workers”), and the average revenue and profits for affected entities and establishments by six-digit NAICS industry.⁴⁷ The agency provided this information for each affected industry as a whole, as well as for small entities, as defined by the Small Business Administration (SBA), and “very small” entities, defined by OSHA as those with fewer than 20 employees, in each affected industry (U.S. Census Bureau, 2014). For each industry sector identified, the agency described the uses of beryllium and estimated the number of establishments and employees that would be affected by the beryllium standards. Employee exposure to beryllium can also occur as a result of certain processes (such as welding) that are found in many industries. This analysis will use the term “application group” to refer to a cross-industry group with a common process.

In Chapter III of the 2017 FEA, OSHA described each application group; identified the processes and occupations with beryllium exposure, including available sampling exposure measurements; and explained how OSHA estimated the number of establishments working with beryllium and the number of employees exposed to beryllium. Those estimates and the exposure profiles for abrasive blasting in construction and shipyards, and welding in shipyards,⁴⁸ are

⁴⁷ The Census Bureau defines an establishment as a single physical location at which business is conducted or services or industrial operations are performed. The Census Bureau defines a business firm or entity as a business organization consisting of one or more domestic establishments in the same state and industry that are specified under common ownership or control. The firm and the establishment are the same for single-establishment firms. For each multi-establishment firm, establishments in the same industry within a state will be counted as one firm; the firm employment and annual payroll are summed from the associated establishments. (U.S. Census Bureau, Statistics of U.S. Businesses, Glossary, 2017, <https://www.census.gov/programs-surveys/susb/about/glossary.html> (Accessed March 3, 2017)).

⁴⁸ The exposure profile used for welding in shipyards in this FEA, and in the 2017 PEA, differs from the exposure profile used in Chapter III the 2017 FEA because OSHA is now using maritime-specific data from the appendices to Chapter IV of the 2017 FEA. See 82 FR 29195.

presented in this section, along with a brief description of the application groups and an explanation of the derivation of the revised exposure profiles. For additional information about these data and the application groups, please see Chapter III of the 2017 FEA.⁴⁹ Finally, this section discusses wage data, the hire rate, and current industry practices.

Affected Application Groups

OSHA's 2017 FEA identified one affected application group in the construction sector and two application groups in the shipyard sector with potential beryllium exposure. Both the shipyard and construction sectors have affected employees in the abrasive blasting application group, and the shipyard sector has affected employees in the welding application group. OSHA's understanding of these affected application groups has not changed. For a full description of these application groups, see Chapter III of the FEA for the 2017 final rule (Document ID 2042) and section V.B. of the 2017 construction and shipyards NPRM, the Profile of Affected Application Groups, Establishments, and Employees within the PEA (82 FR at 29189-29200).

As discussed throughout this preamble, several commenters to the October 9, 2019 NPRM took issue with OSHA's focus on abrasive blasters and welders, arguing that construction and shipyards workers in various other jobs may be exposed to beryllium. For example, commenters argued that workers may be exposed to beryllium during the dressing of beryllium-containing non-sparking tools (Document ID 2208, p. 6; 2211, p. 7; 2222, Tr. 17-19) and during decommissioning, demolition, or renovation work at facilities that process beryllium (Document ID 2213, p. 3; 2239, p. 1; 2222, Tr. 84-85). However, as explained in the Summary and Explanation for paragraph (f), these commenters did not provide, nor does the record contain, sufficient data for the agency to characterize exposures in these or any other application groups

⁴⁹ OSHA contractor Eastern Research Group (ERG) provided support for the 2017 FEA.

outside of abrasive blasting and welding. The agency suspects that if additional exposures do occur they are rare, and would not significantly impact the agency's economic analysis.

Other commenters, including the CISC and NDA, suggested that the agency has underestimated the cost of complying with the beryllium standard for construction because, they contend, all construction employers must perform exposure assessment to determine whether beryllium is present at their worksite in trace amounts (Document ID 2203, p. 16; 2205, p. 2). However, as discussed in the Summary and Explanation, apart from certain abrasive blasting media, those materials at the typical construction site that the agency has identified as containing beryllium in trace amounts (i.e. rock, soil, concrete, and brick) are not likely to release airborne beryllium above the action level under foreseeable conditions and therefore do not typically trigger the requirements of the standard. Further, for any additional materials containing comparably low levels of beryllium, an employer may rely on objective data that employees will not be exposed above the PEL for total airborne dust to qualify for the exemption under paragraph (a)(3). Hence the agency does not expect any workplace assessments to be needed for construction sites using typical construction materials containing trace amounts of beryllium.

Accordingly, the application groups for this FEA remain the same as those identified in the 2019 PEA; that is, abrasive blasting in construction and shipyards and certain welding operations in shipyards.

Exposure Profile

This section summarizes the data from the 2017 FEA (see Document ID 2042, FEA Chapter IV – Technological Feasibility). It is presented here for informational purposes only. The information in this section is drawn entirely from the 2017 FEA except for updated revenue data.

Abrasive Blasting in Construction and Shipyards

The primary abrasive blasting job categories include the abrasive blasting operator (blaster) and pot tender (blaster's helper or assistant) during open blasting projects. Support personnel such as pot tenders or abrasive media cleanup workers might also be employed to clean up (e.g., by vacuuming or sweeping) and recycle spent abrasive and to set up, dismantle, and move containment systems and supplies (NIOSH, 1976, Document ID 0779; NIOSH, 1993, 0777; NIOSH, 1995, 0773; NIOSH, 2007, 0770; Flynn and Susi, 2004, 1608; Meeker et al., 2005, 0699).

Section 15 of Chapter IV of the 2017 FEA included a detailed discussion of exposure data and analysis for the development of the exposure profile for workers in abrasive blasting operations. Because OSHA addressed general industry abrasive blasting operations in other general industry sections where appropriate, such as in the nonferrous foundries industry, the exposure profile in Section 15 addressed only exposure data from construction and shipyard tasks. The exposure profile for abrasive blasters, pot tenders/helpers, and abrasive media cleanup workers was based on two National Institute for Occupational Safety and Health (NIOSH) evaluations of beryllium exposure from abrasive blasting with coal slag, unpublished sampling results for abrasive blasting operations from four U.S. shipyards, and data submitted by the U.S. Navy (NIOSH, 1983, Document ID 0696; NIOSH, 2007, 0770; OSHA, 2005, 1166; U.S. Navy, 2003, 0145).

Welding in Shipyards

Similar to the profile for abrasive blasting activities, OSHA used exposure data from the 2017 FEA to develop the exposure profile for welding in shipyards. OSHA used the exposure data from Chapter IV-10 Appendices 2 and 3 and combined the aluminum base metal and non-

aluminum or unknown base material data. OSHA removed shorter duration samples that appeared in Appendix 3 of FEA chapter IV-10. Seven maritime welding samples from Appendix 3, Table IV.61 with sampling durations of 240 minutes or greater were used in this profile to represent the 8-hour TWA samples.

Compared to the 2017 FEA, this caused a change in the exposure profile for welders in shipyards. The exposure profile for welding in shipyards is based on data presented in Appendices 2 and 3 of Sections 10.6 and 10.7 of Chapter IV, and again is more fully summarized in Section IV of the 2017 PEA. Those data measure exposures of shipyard-based welders, and OSHA has determined that it is a more suitable data set on which to base the exposure profile of welders in shipyards than the data used in the 2017 FEA, which were based on general industry welding exposures.

Tables IV-1 and IV-2 summarize, from the exposure profiles, the number of workers at risk of beryllium exposure and the distribution of 8-hour TWA beryllium exposures by affected application group and job category. Exposures are grouped into ranges (e.g., $> 0.05 \mu\text{g}/\text{m}^3$ and $< 0.1 \mu\text{g}/\text{m}^3$) to show the percentages of employees in each job category and sector exposed at levels within the indicated range.

Table IV-3 presents data by NAICS code on the estimated number of workers at risk of beryllium exposure for each of the same exposure ranges, based on the exposure profile data and the estimated number of workers in each job category and application group. As shown, an estimated 2,168 workers have beryllium exposures above the TWA PEL of $0.2 \mu\text{g}/\text{m}^3$.

Table IV-1: Distribution of Beryllium Exposures by Application Group and Job Category or Activity

Job Category/Activity	Exposure Level ($\mu\text{g}/\text{m}^3$)								Total
	0 to ≤ 0.05	>0.05 to ≤ 0.1	>0.1 to ≤ 0.2	>0.2 to ≤ 0.25	>0.25 to ≤ 0.5	>0.5 to ≤ 1.0	>1.0 to ≤ 2.0	>2.0	
Abrasive Blasting – Construction									
Abrasive Blaster	15.2%	15.2%	25.7%	2.5%	12.4%	4.7%	5.4%	18.9%	100.0%
Pot Tender	28.1%	28.1%	43.8%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cleanup	33.3%	33.3%	26.7%	0.0%	0.0%	0.0%	3.3%	3.3%	100.0%
Abrasive Blasting – Shipyards									
Abrasive Blaster	15.2%	15.2%	25.7%	2.5%	12.4%	4.7%	5.4%	18.9%	100.0%
Pot Tender	28.1%	28.1%	43.8%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Cleanup	33.3%	33.3%	26.7%	0.0%	0.0%	0.0%	3.3%	3.3%	100.0%
Welding – Shipyards									
Welder	47.4%	47.4%	1.5%	0.0%	0.0%	3.0%	0.7%	0.0%	100.0%

Note: Data may not sum to totals due to rounding.

[a] The lowest exposure range in OSHA’s technological feasibility analysis is $\leq 0.1 \mu\text{g}/\text{m}^3$ (see Chapter IV-02, Limits of Detection for Beryllium Data, in the 2017 FEA (Document ID 2042)). Because OSHA lacked information on the distribution of worker exposures in this range, the agency evenly divided the workforce exposed at or below $0.1 \mu\text{g}/\text{m}^3$ into the two categories shown in this table and in the columns with identical headers in Tables IV-2 and IV-3 of this PEA. OSHA recognizes that this simplifying assumption may overestimate exposure in these lower exposure ranges.

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

** Employers in application group Welding in Shipyards employ welders in shipyards. Some of these employers may do both welding and abrasive blasting.

Source: Table V-7, 2017 beryllium proposal (82 FR at 29195).

Table IV-2: Number of Workers Exposed to Beryllium by Affected Application Group, Job Category, and Exposure Range (mg/m³)

Application Group/ Job Category	Exposure Level (µg/m ³)								Total
	0 to ≤0.05	>0.05 to ≤0.1	>0.1 to ≤0.2	>0.2 to ≤0.25	>0.25 to ≤0.5	>0.5 to ≤1.0	>1.0 to ≤2.0	>2.0	
Abrasive Blasting – Construction									
Abrasive Blaster	511	511	863	83	416	159	182	636	3,360
Pot Tender	945	945	1,470	0	0	0	0	0	3,360
Cleanup	560	560	448	0	0	0	56	56	1,680
Abrasive Blasting – Shipyards									
Abrasive Blaster	186	186	314	30	152	58	66	232	1,224
Pot Tender	344	344	536	0	0	0	0	0	1,224
Cleanup	204	204	163	0	0	0	20	20	612
Welding – Shipyards									
Welder	13	13	1	0	0	1	1	0	26
Total									
Construction Subtotal	2,016	2,016	2,781	83	416	159	238	692	8,400
Maritime Subtotal	747	747	1,013	30	152	59	87	252	3,086
Total, All Industries	2,763	2,763	3,794	114	568	218	324	944	11,486

Note: Data may not sum to totals due to rounding. Figures with actual values representing less than one person have been rounded up to one (person).

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

** Employers in application group Welding in Shipyards employ welders in shipyards. Some of these employers may do both welding and abrasive blasting.

Source: Table V-8, 2017 beryllium proposal (82 FR at 29196).

Table IV-3: Number of Workers Exposed to Beryllium by Affected Industry and Exposure Level (mg/m³)

Application Group/ NAICS	Industry	Exposure Level (µg/m ³)								Total
		0 to ≤0.05	>0.05 to ≤0.1	>0.1 to ≤0.2	>0.2 to ≤0.25	>0.25 to ≤0.5	>0.5 to ≤1.0	>1.0 to ≤2.0	>2.0	
Abrasive Blasting – Construction										
238320	Painting and Wall Covering Contractors	1,046	1,046	1,443	43	216	82	123	359	4,360
238990	All Other Specialty Trade Contractors	970	970	1,337	40	200	76	114	333	4,040
Abrasive Blasting – Shipyards										
336611a	Ship Building and Repairing	734	734	1,013	30	152	58	87	252	3,060
Welding in Shipyards										
336611b	Ship Building and Repairing	13	13	1	0	0	1	1	0	26
Total										
Construction Subtotal		2,016	2,016	2,781	83	416	159	238	692	8,400
Maritime Subtotal		747	747	1,013	30	152	59	87	252	3,086
Total, All Industries		2,763	2,763	3,794	114	568	218	324	944	11,486

Note: Data may not sum to totals due to rounding. Figures with actual values representing less than one person have been rounded up to one (person).

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

** Employers in application group Welding in Shipyards employ welders in shipyards. Some of these employers may do both welding and abrasive blasting.

Source: Table V-9, 2017 beryllium proposal (82 FR at 29196).

Summary of Affected Establishments and Employers

As shown in Table IV-4, OSHA estimates that a total of 11,486 workers in 2,796 establishments will be affected by this rule. Also shown are the estimated annual revenues for these entities. Table IV-5 presents the agency's estimate of affected entities defined as small by SBA, and Table IV-6 presents OSHA's estimate of affected establishments and employees by NAICS industries for the subset of small entities with fewer than 20 employees.⁵⁰ For the tables showing the characteristics of small and very small entities, OSHA generally assumed that beryllium-using small entities and very small entities would be the same proportion of overall small and very small entities as the proportion of beryllium-using entities to all entities as a whole in a NAICS industry. OSHA in the 2017 PEA and subsequent rulemaking analyses has requested public comment on the profile data presented in Tables IV-4, IV-5, and IV-6, and has received none.

⁵⁰ Tables IV-5 and IV-6 indicate that small entities affected by the proposed rule contain 2,714 affected establishments affiliated with entities that are small by SBA standards and 2,365 affected establishments affiliated with entities that employ fewer than 20 employees. However, the small and very small entity figures in Tables IV-5 and IV-6 were not used to prepare the cost savings estimates in Section D of this FEA. For costing purposes in Section D, OSHA included small establishments owned by larger entities versus the figures in Tables IV-5 and IV-6 because such establishments do not qualify as "small entities" for the purposes of a Regulatory Flexibility Analysis. To see the difference in the number of affected establishments by size for costing purposes, consider the example of a "large entity" with 500 employees, consisting of 50 ten-employee establishments. In Section B., each of these 50 establishments would be excluded from Tables IV-5 and IV-6 because they are part of a "large entity"; in Section D., where all establishments are included because there is no filter for entity size, each would be considered a small establishment. Thus, for purposes of Section D., there are 2,399 affected establishments with fewer than 20 employees, 369 affected establishments with between 20 and 499 employees, and 28 establishments with more than 500 employees. Census (2015) Statistics of US Businesses data suggest there are also a total of 3,464 establishments affiliated with entities in construction and shipyards employing between 20 and 499 employees, of which approximately 157 would be affected by the rule.

Table IV-4: Characteristics of Industries Affected by OSHA's Beryllium Standards - All Entities

NAICS Code	Industry	Total Entities [a]	Total Establishments [a]	Total Employees [a]	Affected Entities [b]	Affected Establishments [b]	Affected Employees [b]	Total Revenues (\$1,000) [a]	Revenues/Entity [a]	Revenues/Establishment [a]
Abrasive Blasting – Construction										
238320	Painting and Wall Covering Contractors	31,317	31,376	163,073	1,088	1,090	4,360	\$21,099,458	\$673,738	\$672,471
238990	All Other Specialty Trade Contractors	28,734	29,072	193,631	998	1,010	4,040	\$42,420,391	\$1,476,313	\$1,459,149
Abrasive Blasting – Shipyards										
336611a	Ship Building and Repairing	604	689	108,311	604	689	3,060	\$28,142,463	\$46,593,482	\$40,845,374
Welding in Shipyards										
336611b	Ship Building and Repairing	604	689	108,311	6	7	26	\$28,142,463	\$46,593,482	\$40,845,374
Total										
Construction Subtotal		60,051	60,448	356,704	2,086	2,100	8,400	\$63,519,849	\$1,057,765	\$1,050,818
Maritime Subtotal		604	689	108,311	610	696	3,086	\$28,142,463	\$46,593,482	\$40,845,374
Total, All Industries		60,655	61,137	465,015	2,696	2,796	11,486	\$91,662,312	\$1,511,208	\$1,499,294

[a] Data may not sum to totals due to rounding. [a] US Census Bureau, Statistics of US Businesses: 2012 (Document ID 2034).

[b] OSHA estimates of employees potentially exposed to beryllium and associated entities and establishments. Affected entities and establishments constrained to be less than or equal to the number of affected employees.

Source: Table V-4, 2017 beryllium proposal (82 FR at 29192), with updated revenues as shown in Document ID 2250.

Table IV-5: Characteristics of Construction and Shipyard Industries Affected by OSHA's Beryllium Standards - Small Entities

NAICS Code	Industry	SBA Small Business Classification (Employees) [a]	Small Business Entities [b]	Establishments for Small Entities [b]	Small Entity Employees [b]	Affected Small Business Entities [c]	Affected Small Establishments [c]	Affected Employees for Small Entities [c]	Total Revenues for Small Entities (\$1,000) [b]	Revenues/Small Entity	Revenues/Small Establishment
Abrasive Blasting – Construction											
238320	Painting and Wall Covering Contractors	100	31,221	31,243	133,864	1,085	1,085	3,579	\$17,822,841	\$570,861	\$570,459
238990	All Other Specialty Trade Contractors	100	28,537	28,605	143,112	991	994	2,986	\$32,076,205	\$1,124,022	\$1,121,350
Abrasive Blasting – Shipyards											
336611a	Ship Building and Repairing	1,250	585	629	27,170	585	629	768	\$6,507,836	\$11,124,507	\$10,346,322
Welding in Shipyards											
336611b	Ship Building and Repairing	1,250	585	629	27,170	6	6	7	\$6,507,836	\$11,124,507	\$10,346,322
Total											
Construction Subtotal		-	59,758	59,848	276,976	2,076	2,079	6,565	\$49,899,046	\$835,019	\$833,763
Maritime Subtotal		-	585	629	27,170	591	635	775	\$6,507,836	\$11,124,507	\$10,346,322
Total, All Industries		-	60,343	60,477	304,146	2,667	2,714	7,340	\$56,406,882	\$934,771	\$932,700

Data may not sum to totals due to rounding.

[a] SBA Size Standards, 2016.

[b] US Census Bureau, Statistics of US Businesses: 2012 (Document ID 2034).

[c] OSHA estimates of employees potentially exposed to beryllium and associated entities and establishments. Affected entities and establishments constrained to be less than or equal to the number of affected employees.

Source: Table V-5, 2017 beryllium proposal (82 FR at 29194), with updated revenues as shown in Document ID 2250.

Table IV-6: Characteristics of Industries Affected by OSHA’s Beryllium Standards - Entities with Fewer Than 20 Employees

Application Group	NAICS	Industry	Entities with <20 Employees [a]	Establishments for Entities with <20 Employees [a]	Employees for Entities with <20 Employees [a]	Affected Entities with <20 Employees [b]	Affected Establishments for Entities with <20 Employees [b]	Affected Employees for Entities with <20 Employees [b]	Total Revenues for Entities with <20 Employees (\$1,000) [a]	Revenues Per Entity with <20 Employees	Revenue per Estab. For Entities with <20 Employees
Abrasive Blasting – Construction											
Abrasive Blasting - Construction	238320	Painting and Wall Covering Contractors	29,953	29,957	87,984	1,041	1,041	2,352	\$11,448,144	\$382,204	\$382,153
Abrasive Blasting - Construction	238990	All Other Specialty Trade Contractors	27,026	27,041	90,82	939	939	1,895	\$20,708,351	\$766,238	\$765,813
Abrasive Blasting – Shipyards*											
Abrasive Blasting - Shipyards	336611a	Ship Building and Repairing	380	381	2,215	380	381	381	\$589,796	\$1,552,093	\$1,548,020
Welding in Shipyards**											
Welding in Shipyards	336611b	Ship Building and Repairing	380	381	2,215	4	4	4	\$589,796	\$1,552,093	\$1,548,020
Total											
Construction Subtotal			56,979	56,998	178,806	1,980	1,980	4,247	\$32,156,495	\$564,357	\$564,169
Shipyards Subtotal			380	381	2,215	384	385	385	\$589,796	\$1,552,093	\$1,548,020
Total, All Industries			57,359	57,379	181,021	2,364	2,365	4,632	\$32,746,291	\$570,901	\$570,702

Data may not sum to totals due to rounding.

[a] US Census Bureau, Statistics of US Businesses: 2012 (Document ID 2034).

[b] OSHA estimates of employees potentially exposed to beryllium and associated entities and establishments. Affected entities and establishments constrained to be less than or equal to the number of affected employees.

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

** Employers in application group Welding in Shipyards employ welders in shipyards. Some of these employers may do both welding and abrasive blasting.

Source: Table V-6, 2017 beryllium proposal (82 FR at 29195), with updated revenues as shown in Document ID 2250.

Loaded Wages and New Hire Rate

For this FEA, OSHA updated the wage estimates from the 2019 PEA. Data for base wages by Standard Occupational Classification (SOC) are from the May 2019 Occupational Employment Statistics survey of the Bureau of Labor Statistics (BLS). OSHA applied a fringe markup (loading factor) of 45.8 percent of base wages (see BLS, Employer Costs for Employee Compensation, March 2019 (Document ID 2249), available at https://www.bls.gov/news.release/archives/ecec_06182019.htm) (BLS, 2020c);⁵¹ loaded hourly wages by application group and SOC are shown in Table IV-7. OSHA also used the new hire rate for manufacturing of 31.8 percent (BLS, Job Openings and Labor Turnover Survey (JOLTS), 2019 (Document ID 2247), available at <http://www.bls.gov/jlt/data.htm>) (BLS, 2020b). Finally, due to changes in data availability in the most recent OES, the occupation for a PLCHP, which in the PEA used Family and General Physicians (SOC 29-1062), has been changed to Physicians, All Other; and Ophthalmologists, Except Pediatric (SOC 29-1228).

Baseline Industry Practices and Existing Regulatory Requirements (“Current Compliance”) On Hazard Controls and Ancillary Provisions

Table IV-8 reflects OSHA’s estimate of baseline industry compliance rates, by application group and job category, for each of the ancillary provisions in the construction and shipyards standards. See Chapter III of the 2017 FEA (Document ID 2042) for additional discussion of the baseline compliance rates for each provision, which were estimated based on site visits, industry contacts, published literature, and the Final Report of the Small Business

⁵¹ A fringe markup (loading factor) of 45.8 percent was calculated in the following way. Employer costs for employee compensation for civilian workers averaged \$36.77 per hour worked in March 2019. Wages and salaries averaged \$25.22 per hour worked and accounted for 68.6 percent of these costs, while benefits averaged \$11.55 and accounted for the remaining 31.41 percent. Therefore, the fringe markup (loading factor) is \$11.55/\$25.22, or 45.8 percent. Total employer compensation costs for private industry workers averaged \$34.49 per hour worked in March 2019 (BLS, 2020c, Document ID 2249).

Advocacy Review (SBAR) Panel (SBAR, 2008, Document ID 0345). Note that the compliance rate is typically the same for all jobs in a given sector.

In the 2017 FEA, OSHA estimated that abrasive blasters in construction and shipyards had a 75 percent compliance rate with the PPE requirements in the beryllium standards. The 2017 PEA revised those estimates to 100 percent compliance based on the belief that 29 CFR 1926.57(f)(5)(v) already required abrasive blasting operators to wear full PPE, including respirators, gloves, safety shoes, and eye protection; that 29 CFR 1915.34(c)(3) required full PPE for abrasive blaster operators performing mechanical paint removal in shipyards. Some commenters disagreed with this estimate for abrasive blasting operations. NABTU noted that “with the exception of abrasive blasting operators wearing type CE respirators, construction workers’ use of PPE during abrasive blasting operations is extremely limited.” (Document ID 2129, p. 11). BHSC also expressed concern about the degree of protection afforded by the other OSHA standards to workers near abrasive blasting operations, stating that the estimated 100 percent PPE use for those workers “does not have supporting evidence of consistent and standard use across pot tenders and cleanup activities supporting abrasive blasting” (Document ID 2118, p. 5).

While the agency acknowledges these comments claiming that its revised 100 percent compliance estimate was too high for abrasive blasting operations, OSHA is also removing dermal contact with beryllium as a trigger for PPE requirements. This clarifies and limits the activities that would trigger PPE requirements under this rule, making a higher baseline compliance estimate more appropriate. The agency has determined that a better estimate for PPE for abrasive blasting operations is in between the two previous estimates of 75 percent and 100 percent. OSHA estimates 90 percent compliance for PPE for areas where exposures exceed, or

can reasonably be expected to exceed, the TWA PEL or STEL, which are the only areas in which the standards would require PPE under the revisions.

For welders in shipyards, OSHA estimated a 0 percent compliance rate in the 2017 FEA and revised that estimate to 100 percent compliance in the 2017 PEA because gloves are required under 29 CFR 1915.157(a) to protect workers from hazards faced by welders, such as thermal burns (82 FR at 29197-201). The agency received no comments on the compliance rates for welders either from the 2017 PEA or from the 2019 PEA. Hence, OSHA continues to estimate a 100 percent PPE compliance rate for welders in shipyards in areas where exposures can exceed the TWA PEL or STEL because of the overlap with 29 CFR 1915.157(a).⁵²

In the 2017 FEA, for the three occupational groups involved in abrasive blasting (operators, pot-tenders, and clean-up workers), OSHA estimated a 75 percent compliance rate with respirators that met the beryllium standards' requirements. In the 2017 PEA (82 FR at 29197), operators, but not pot tenders or clean-up workers, were revised to 100 percent compliance due to the strict existing standards for operators (see §§1926.57(f) and 1915.34(c)(3)(iv)). This FEA continues to use these baseline compliance estimates of 100 percent for operators and 75 percent for pot tenders and clean-up workers.

For welders in shipyards, the 2017 FEA estimated 0 percent compliance with proper respirator use and a 25 percent compliance rate with the requirement to establish a respiratory protection program. OSHA revised this estimate to 100 percent in the 2019 PEA (84 FR at 53927) because several other standards address respiratory protection for welders in shipyards, including the Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard

⁵² In fact, the 0 percent baseline compliance rate for PPE in shipyard welding in the 2017 FEA was simply a mistake insofar as baseline compliance rate for PPE for welding in general industry was 100 percent in the same document. 2017 FEA, Ch. III, p. III-188.

Employment standards (29 CFR 1915.12(c)(4)(ii)), the Welding, Cutting, and Heating standards for shipyards (29 CFR 1915.51(d)(2)(iv)), and the general Respiratory Protection standards (29 CFR 1910.134, 1915.154). The agency received no new comment on these revisions to the compliance rates from either the 2017 PEA or the 2019 PEA and will use the same estimates in this FEA.

The baseline compliance rates for the housekeeping provisions in the 2017 FEA were 0 percent for welders in shipyards and 75 percent for blasters, pot tenders, and clean-up workers in abrasive blasting in both construction and shipyards. In the 2017 PEA, OSHA reviewed existing housekeeping requirements and updated the estimate from 75 percent to 100 percent for abrasive blasting operations because some housekeeping is required by existing standards for abrasive blasting operations in construction and shipyards. The Summary and Explanation for housekeeping for this rule discusses the agency's finding that existing standards cover general housekeeping requirements for blasters, pot tenders, and clean-up workers, though these other standards allow some cleaning methods that the beryllium standards, and the revisions, limit, like dry sweeping or brushing and compressed air. Under this rule, housekeeping requirements would no longer apply when dust from trace amounts of beryllium could not be expected to cause airborne exposures above the TWA PEL and STEL. Hence, these requirements will only affect areas where workers are exposed above the TWA PEL or STEL in the exposure profile. While the revisions will limit the methods that employers may use to clean up beryllium, OSHA estimates that cleaning methods that do not disperse beryllium into the air take approximately the same amount of time as cleaning methods already in use. The agency received no comment on this revision to the compliance rate from either the 2017 PEA or the 2019 PEA. For abrasive

blasting operations, the agency therefore maintains from the 2017 PEA its 100 percent compliance rate for housekeeping for abrasive blasting operations.

For welders in shipyards, OSHA estimated a 0 percent compliance rate for housekeeping in both the 2017 FEA and the 2017 PEA. As explained in the Summary and Explanation, OSHA has reason to believe that skin or surface contamination is not an exposure source of concern in welding in shipyards. The revisions would also limit the circumstances in which housekeeping is required. OSHA therefore estimates that in welding in shipyards, employers will not have to engage in additional housekeeping to comply with the revisions and is maintaining its 2019 PEA baseline compliance estimate for housekeeping to 100 percent for welding in shipyards.

In the 2017 PEA, OSHA treated the compliance rates for vacuums, bags, and labels separately from the labor costs of housekeeping. OSHA estimated a 0 percent compliance rate for all industries in construction and shipyards for vacuums, bags, and labels because it believed the cost of such equipment was not covered by other standards. In this FEA, as in the 2019 PEA, OSHA is setting the compliance rates under housekeeping for vacuums, bags, and labels to 100 percent as this rule removes those requirements from the standard.

The baseline compliance rates for the hygiene areas provisions in the 2017 FEA were 0 percent for welders in shipyards and 75 percent for blasters, pot tenders, and clean-up workers in abrasive blasting in both construction and shipyards. As explained in the Summary and Explanation section of this preamble, OSHA is removing paragraph (i), hygiene areas, from the construction and shipyards standards. The standards as modified by this final rule, as in the NPRM, therefore no longer require employers to comply with any hygiene-related provisions, and the baseline compliance is revised to 100 percent to demonstrate that there will be no cost associated with hygiene areas under the rule.

The baseline compliance rate for each of the remaining provisions was unchanged from the 2017 FEA to the 2017 PEA and remains unchanged in this FEA.

As a final point on baseline industry practices, OSHA acknowledges the possibility of a future decline in the use of coal slag abrasive materials but did not receive new evidence on this issue. To the extent that coal slag abrasives are being replaced, for reasons unrelated to the implementation of this standard, by other blasting materials that do not have the potential for beryllium exposures of concern, the costs and benefits of compliance with the TWA PEL and STEL for abrasive blasting operations would also decrease.

Table IV-7: Loaded Hourly Wages for Occupations (Jobs) Exposed to Beryllium and Affected by OSHA’s Beryllium Standard

Provision in the Standard	Job	NAICS	SOC[a]	Occupation	Median Hourly Wage	Fringe Markup Percentage, Total [b]	Loaded Hourly (or Daily[d]) Wage
Monitoring [c]	Industrial Hygienist Consultant						\$175.34
Monitoring [d]	IH Technician – Initial	N/A	N/A	N/A	N/A	N/A	\$2,808.63
	IH Technician - Additional and Periodic						\$1,379.86
Regulated Area/Job Briefing [e]	Production Worker	31-33	51-0000	Production Occupations	\$17.78	45.8%	\$25.92
Medical Surveillance [e]	Human Resources Manager	31-33	11-3121	Human Resources Managers	\$55.29	45.8%	\$80.61
Exposure Control Plan, Medical Surveillance, and Medical Removal [e]	Clerical	31-33	43-4071	File Clerks	\$16.98	45.8%	\$24.76
Training [e]	Training Instructor	31-33	13-1151	Training and Development Specialists	\$28.94	45.8%	\$42.19
Medical Surveillance [e]	Physician (Employers' Physician)	31-33	29-1228	Physicians, All Other; and Ophthalmologists, Except Pediatric	\$94.10	45.8%	\$137.19
Multiple Provisions [f]	First Line Supervisor	Various	51-1011	First-Line Supervisors of Production and Operating Workers	\$30.30	45.8%	\$44.18

Sources: U.S. Dept. of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

[a] 2010 Standard Occupational Classification System. Bureau of Labor Statistics. <http://www.bls.gov/soc/classification.htm>.

[b] BLS, 2020c. 45.8 percent represents fringe as a percentage of base wages. BLS-reported data for fringe as a percentage of total compensation is 31.4 percent.

[c] ERG estimates based on discussions with affected industries, and inflated to 2019 Dollars.

[d] Wages used in the economic analysis for the Silica final rule, inflated to 2019 Dollars.

[e] BLS, 2020a

[f] BLS, 2020a; Weighted average for SOC 51-1011 in NAICS 313000, 314000, 315000, 316000, 321000, 322000, 323000, 324000, 325000, 326000, 327000, 335000, 336000, 337000, and 339000.

Table IV-8: Estimated Current Compliance Rates for Industry Sectors Affected by OSHA’s Beryllium Standard

Application Group	Job	Exposure Assessment	Regulated Areas/Competent Person	Medical Surveillance	Medical Removal Program	Exposure Control Plan	PPE	Hygiene		Training	Respirators		Housekeeping	
								Employees	Establishments		Employee / Respirator	Establishment/ Respirator Program	Labor	Vacuum, Bags, Labels
Abrasive Blasting – Construction														
Abrasive Blasting - Construction	Abrasive Blaster	0%	75%	75%	0%	75%	90%	100%	100%	75%	100%	100%	100%	100%
Abrasive Blasting - Construction	Pot Tender	0%	75%	75%	0%	75%	90%	100%	100%	75%	75%	75%	100%	100%
Abrasive Blasting - Construction	Cleanup	0%	75%	75%	0%	75%	90%	100%	100%	75%	75%	75%	100%	100%
Abrasive Blasting – Shipyards														
Abrasive Blasting - Shipyards	Abrasive Blaster	0%	75%	75%	0%	75%	90%	100%	100%	75%	100%	100%	100%	100%
Abrasive Blasting - Shipyards	Pot Tender	0%	75%	75%	0%	75%	90%	100%	100%	75%	75%	75%	100%	100%
Abrasive Blasting - Shipyards	Cleanup	0%	75%	75%	0%	75%	90%	100%	100%	75%	75%	75%	100%	100%
Welding – Shipyards														
Welding - Shipyards	Welder	0%	0%	0%	0%	0%	100%	100%	100%	0%	100%	100%	100%	100%

Source: U.S. Dept. of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

[a] Estimated compliance rates for medical surveillance do not include medical referrals. OSHA estimates that baseline compliance rates for medical referrals are zero percent for all application groups shown in the table.

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasive to etch the surfaces of boats and ships.

** Employers in application group Welding in Shipyards employ welders in shipyards. Some of these employers may do both welding and abrasive blasting.

C. Technological Feasibility Summary

This section summarizes OSHA's technological feasibility findings made in the 2017 FEA (see Document ID 2042, FEA Chapter IV – Technological Feasibility). Because this final rule contains no new requirements that might raise feasibility concerns, OSHA's technological feasibility analysis remains unchanged from the 2017 final rule. The findings are presented here for informational purposes only. The information in this section is drawn entirely from the 2017 FEA and contains no new information or assessment.

Overall, based on the information discussed in Chapter IV of the 2017 FEA, OSHA determined that the majority of the exposures in construction and shipyards are either already at or below the new final PEL, or can be adequately controlled to levels below the final PEL through the implementation of additional engineering and work practice controls for most operations most of the time. The one exception is that OSHA determined that workers who perform open-air abrasive blasting using mineral grit (i.e., coal slag) will routinely be exposed to levels above the final PEL even after the installation of feasible engineering and work practice controls, and therefore, these workers will also be required to wear respiratory protection. Therefore, OSHA concluded in the January 9, 2017 final rule that the final PEL of $0.2 \mu\text{g}/\text{m}^3$ is technologically feasible in abrasive blasting in construction and shipyards and in welding in shipyards.

D. Costs of Compliance

Introduction

Throughout this section, OSHA presents cost-saving formulas in the text, usually in parentheses, to help explain the derivation of cost-saving estimates for the individual provisions. Because the values used in the formulas shown in the text are shown only to the second decimal

place, while the spreadsheets supporting the text are not limited to two decimal places, the calculation using the presented formula will sometimes differ slightly from the totals presented in the tables.

These estimates of cost savings are largely based on the cost estimates presented for Regulatory Alternative 2a in the preamble for the 2017 final rule (82 FR at 2612-15), which were in turn derived from the Costs of Compliance chapter (Chapter V) of the 2017 FEA. OSHA has retained the same calculation methods from the 2017 FEA, detailed in Chapter V of that document, and has updated all wages and unit costs to 2019 dollars. All cost savings in this FEA similarly are expressed in 2019 dollars and were annualized using discount rates of 3 percent and 7 percent, as required by OMB.⁵³ Unit costs developed in this section were multiplied by the number of workers who would have to comply with the provisions, as identified in Section B of this FEA (Profile of Affected Application Groups, Establishments, and Employees). The estimated number of affected workers depends on what level of exposure triggers a particular provision and the percentage of those workers already in compliance. In a few cases, costs were calculated based on the number of firms. As in the 2017 FEA, OSHA is estimating that the beryllium standards will reduce the number of workers exposed to beryllium over the PEL by 90 percent. Therefore, for ancillary provisions that require employers to take action for employees who continue to be exposed over the PEL, like respiratory protection and PPE, OSHA estimates the cost based on ten percent of the number of employees exposed over the PEL in the exposure profiles.

⁵³ See OMB Memo M-17-21 (April 5, 2017), available at <https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2017/M-17-21-OMB.pdf>. OSHA included the 3 percent rate in its primary analysis, but Appendix IV-A of this PEA also presents costs by NAICS industry and establishment size categories using, as alternatives, a 7 percent discount rate—shown in Table IV-21—and a 0 percent discount rate—shown in Table IV-22.

For purposes of calculating costs, OSHA assumes a 250-day work year. This is a standard calculation that OSHA and others use, which assumes employees work 5 days a week with 2 weeks of vacation, resulting in 250 work days per year (50 weeks x 5 work days a week).

Estimated compliance rates are presented in Table IV-8 in Section B of this FEA. The estimated costs for this beryllium rule represent the additional costs necessary for employers to achieve full compliance with the rule. The costs of complying with the beryllium program requirements therefore depend on the extent to which employers in affected application groups have already undertaken some of the required actions. A discussion of affected workers is presented in Section B of this FEA. Complete calculations are available in the OSHA spreadsheet in support of the FEA (Document ID 2250). Annualization periods for expenditures on equipment are based on equipment life, and one-time costs are annualized over a 10-year period.⁵⁴ The agency first presents costs for the full 2017 final rule with only updated wages, unit costs, and hiring rates based on 2019 data, updated from the PEA for this proposal. All other estimates (compliance rates, exposure profile, etc.) are the same as the 2017 FEA. This is the baseline from which all cost savings of the rule are benchmarked.

Table IV-9 shows these costs, which total for all occupations in construction and shipyards to \$12.8 million at a discount rate of 3 percent, an increase of 4 percent from the equivalent cost for the 2017 FEA (\$12.3 million).

⁵⁴ Executive Order 13563 directs agencies “to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible.” In addition, OMB Circular A-4 suggests that analysis should include all future costs and benefits using a “rule of reason” to consider for how long it can reasonably predict the future and limit its analysis to this time period. Annualization should not be confused with depreciation or amortization for tax purposes. Annualization spreads costs out evenly over the time period (similar to the payments on a mortgage) to facilitate comparison of costs and benefits across different years. In cases where costs occur on an annual basis, but do not change between years, annualization is not necessary, and OSHA may refer simply to “annual” costs.

Table IV-9: Total Annualized Costs of full 2017 final Beryllium rule, by Sector and Six-Digit NAICS Industry; Results Shown by Size Category (3 Percent Discount Rate, 2019 Dollars)

Application Group/ NAICS	Industry	All Establishments	Small Entities (SBA-defined)	Very Small Entities (<20 Employees)
Abrasive Blasting – Construction				
238320	Painting and Wall Covering Contractors	\$4,770,711	\$4,018,176	\$2,815,214
238990	All Other Specialty Trade Contractors	\$4,421,009	\$3,399,888	\$2,321,792
Abrasive Blasting – Shipyards				
336611a	Ship Building and Repairing	\$3,581,319	\$1,148,925	\$602,325
Welding in Shipyards				
336611b	Ship Building and Repairing	\$75,030	\$21,996	\$12,306
Total				
Construction Subtotal		\$9,191,720	\$7,418,064	\$5,137,007
Maritime Subtotal		\$3,656,348	\$1,170,921	\$614,631
Total, All Industries		\$12,848,069	\$8,588,985	\$5,751,638

Notes:

Figures in rows may not add to totals due to rounding.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250)

To estimate the cost savings of this rule, OSHA estimated the difference between the costs of the 2017 final rule (with updated wages, prices, and hiring rate), Table IV-9, and the costs of this rule. These cost savings are presented and discussed below. Table IV-10 shows first, by affected application group and six-digit NAICS code, annualized cost savings for all establishments, for all small entities (as defined by the Small Business Act and SBA's implementing regulations; see 15 U.S.C. 632 and 13 CFR 121.201), and for all very small entities (defined by OSHA as those with fewer than 20 employees). OSHA estimates that this rule would yield a total annualized cost savings of \$2.5 million using a 3 percent discount rate across the shipyard and construction sectors.

The agency notes that it did not include an overhead labor cost either in the 2017 FEA in support of the January 9, 2017 final standards, the 2017 PEA, the 2019 PEA, or in this FEA. There is not one broadly accepted overhead rate, and the use of overhead to estimate the marginal costs of labor raises a number of issues that should be addressed before applying overhead costs to analyze the costs of any specific regulation. There are several approaches to look at the cost elements that fit the definition of overhead, and there are a range of overhead estimates currently used within the federal government—for example, the Environmental Protection Agency has used 17 percent,⁵⁵ and government contractors have reportedly used an average 50 percent for on-site (i.e., company site) overhead.⁵⁶ Some overhead costs, such as

⁵⁵ Cody Rice, U.S. Environmental Protection Agency, "Wage Rates for Economic Analyses of the Toxics Release Inventory Program," June 10, 2002 (document ID 2025). This analysis itself was based on a survey of several large chemical manufacturing plants: Heiden Associates, Final Report: A Study of Industry Compliance Costs Under the Final Comprehensive Assessment Information Rule, Prepared for the Chemical Manufacturers Association, December 14, 1989.

⁵⁶ For a further example of overhead cost estimates, please see the Employee Benefits Security Administration's guidance at Grant Thornton LLP, *2017 Government Contractor Survey*, <https://www.grantthornton.com/-/media/content-page-files/public-sector/pdfs/surveys/2018/2017-government-contractor-survey>. According to Grant Thornton's *2017 Government Contractor Survey*, on-site rates are generally higher than off-site rates, because the on-site overhead pool includes the facility-related expenses incurred by the company to house the employee, while no such expenses are incurred or allocated to the labor costs of direct charging personnel who work at the customer

advertising and marketing, vary with output rather than with labor costs. Other overhead costs vary with the number of new employees. For example, rent or payroll processing costs may change little with the addition of one employee in a 500-employee firm, but those costs may change substantially with the addition of 100 employees. If an employer is able to rearrange current employees' duties to implement a rule, then the marginal share of overhead costs such as rent, insurance, and major office equipment (e.g., computers, printers, copiers) would be very difficult to measure with accuracy.

If OSHA had included an overhead rate when estimating the marginal cost of labor, without further analyzing an appropriate quantitative adjustment, and adopted for these purposes an overhead rate of 17 percent on base wages, the cost savings of this rule would increase by approximately \$243,000 per year, or approximately 10 percent above the primary estimate of cost savings.

site. For further examples of overhead cost estimates, please see the Employee Benefits Security Administration's guidance at <https://www.dol.gov/sites/dolgov/files/ebsa/laws-and-regulations/rules-and-regulations/technical-appendices/labor-cost-inputs-used-in-ebsa-opr-ria-and-pra-burden-calculations-july-2017.pdf>.

Table IV-10: Total Annualized Cost Savings, by Sector and Six-Digit NAICS Industry, for Entities Affected by the Shipyard and Construction Beryllium Standards (By Size Category, 3 Percent Discount Rate, 2019 Dollars)

Application Group/ NAICS	Industry	All Establishments	Small Entities (SBA- defined)	Very Small Entities (<20 Employees)
Abrasive Blasting – Construction				
238320	Painting and Wall Covering Contractors	\$948,051	\$780,379	\$516,588
238990	All Other Specialty Trade Contractors	\$878,469	\$652,049	\$417,270
Abrasive Blasting – Shipyards*				
336611a	Ship Building and Repairing	\$664,522	\$171,816	\$86,053
Welding in Shipyards**				
336611b	Ship Building and Repairing	\$20,896	\$5,520	\$3,063
Total				
Construction Subtotal		\$1,826,520	\$1,432,428	\$933,858
Shipyards Subtotal		\$685,418	\$177,336	\$89,116
Total, All Industries		\$2,511,938	\$1,609,763	\$1,022,974

Note: Figures in rows may not add to totals due to rounding.

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Program Cost Savings

This subsection presents OSHA's estimated cost savings from this rule for each provision individually. Each provision will be discussed separately below. Because many of the revisions discussed in the 2019 Preliminary Economic Analysis (PEA) are being finalized as proposed, this FEA focuses primarily on differences from the 2017 final rule. Where OSHA has made changes from the 2019 PEA or received comments related to its analysis, the agency discusses those changes and comments. Where there is either no change from the 2017 final rule or a change that does not alter the underlying methodology, such as a change in compliance rates or the elimination of the dermal contact trigger, no underlying methodology or unit cost estimates are presented as they are the same, updated to 2019 dollars, as the 2017 FEA. In other cases both the initial methodology and unit cost estimates are presented. All cost savings by program element, along with the cost savings for each affected NAICS industry, are shown in Table IV-15 at the end of this program cost-savings section.

Exposure Assessment

OSHA did not propose any changes to paragraph (d), Exposure assessment. OSHA is also not changing any estimates to the baseline compliance rate with this paragraph. Hence, there are no cost savings for this provision.

Beryllium Regulated Areas (Shipyards) And Competent Person (Construction)

OSHA is not making any changes to paragraph (e), the regulated areas provision in shipyards or the competent person provision in construction, nor are there any changes to compliance rates. Hence, there are no cost savings for this provision.

Methods of Compliance

Overview of Regulatory Requirements in the 2017 Final Rule

Under the 2017 beryllium standards, employers are required to establish and maintain a written exposure control plan.

Further, employers must review it at least annually, and must update the exposure control plan when:

(A) Any change in production processes, materials, equipment, personnel, work practices, or control methods results or can reasonably be expected to result in new or additional airborne exposures to beryllium;

(B) The employer becomes aware that an employee has a beryllium-related health effect or symptom, or is notified that an employee is eligible for medical removal; or

(C) The employer has any reason to believe that new or additional airborne exposures are occurring or will occur.

Finally, the employer must make a copy of the written exposure control plan accessible to each employee who is, or can reasonably be expected to be, exposed to airborne beryllium.

Paragraph (f)(2)(i) of the 2017 standards requires employers to use at least one engineering or work practice control where exposures are, or can reasonably be expected to be, above the action level unless the employer can establish that such controls are not feasible or that airborne exposure is below the action level. Paragraph (f)(3) prohibits rotation of workers among jobs to achieve compliance with the TWA PEL and STEL.

Cost Savings Estimates of this Rule

For the written exposure control plan, OSHA is making several revisions. First, OSHA is removing the words “airborne” and “or dermal contact with” as qualifiers for exposure to beryllium. This will not change coverage of workers for which a written exposure control plan is needed for these sectors, and would therefore have no impact on costs. This rule would reduce

the number of elements that must be listed in the plan. The elements OSHA is eliminating are: procedures for minimizing cross contamination and the migration of beryllium within or to locations outside the workplace; procedures for removing, laundering, cleaning, storing, repairing, and disposing of beryllium contaminated PPE, including clothing, and equipment including respirators; a separate listing of operations and job titles for those that would entail beryllium exposure above action level; and a separate listing of those that would be above the TWA PEL or STEL. This streamlined written control plan would still include a list of operations and job titles that involve exposure to beryllium; a list of engineering controls, work practices, and respiratory protection; and procedures for restricting access to work areas where airborne exposures are, or can reasonably be expected to be, above the TWA PEL or STEL. OSHA is also including a new requirement to list procedures used to ensure the integrity of each containment used to minimize exposures to employees outside the containment. Finally, there is a change from the NPRM that the written control plan must document procedures for removing, cleaning, and maintaining personal protective clothing and equipment.^{57,58}

The agency estimates that the cost for the written exposure control plan will be cut in half due to the reduced requirements in this rule. This estimate includes the additional time needed for the new paragraphs that require including procedures both for containment and the removal, cleaning, and maintaining of PPE. OSHA estimated in the 2017 final rule that the time burden *per establishment* for an average-sized firm to develop the initial written exposure control plan was 8 hours. With the simplified written plan requirements in this final rule, the agency

⁵⁷ Several commenters discussed the written exposure control plan as it relates to the overall scope of the rule. A discussion of comments on this subject can be found in the Summary and Explanation section. For purposes of this FEA, the agency is not making any adjustments to its scope of affected industries.

⁵⁸ This new addition from the NPRM is judged to have negligible effects on the cost of the written control plan. Hence the cost estimates for this provision in this FEA are the same as the NPRM.

judges that a manager will need only 4 hours, a reduction of 4 hours, for a per establishment cost savings of \$322.44 at an hourly wage of \$80.61 (Human Resources Managers, SOC: 11-3121), to develop the plan.

In addition, because larger firms with more affected workers will need to develop more complicated written control plans, OSHA estimated for the 2017 beryllium standards that the development of a plan would require an extra thirty minutes of a manager's time per affected employee over the 4 hours required for average-sized firms. The reduced number of job titles and operations that would need to be listed in some cases for this rule, as well as other elements, will decrease this burden, and the agency has lowered the time per affected employee to 15 minutes, a reduction of 15 minutes. The cost savings for 15 minutes less of a manager's time per affected employee to develop a less complicated plan is \$20.15 ($0.25 \times \80.61) per affected employee in this FEA.

Because of various triggers under which the employer would have to update the plan at least annually after the first year, the agency further estimated that under the 2017 beryllium standards, on average, managers would need 12 minutes (0.2 hours) per affected employee per quarter—or 48 minutes (4×12), which equals 0.8 hours, per affected employee per year—to review and update the plan. The streamlined plan will similarly be simpler to update, and the agency assumes the amount will be cut in half, from 48 minutes per employee per year to 24 minutes, a reduction of 24 minutes. Thus, the cost savings for managers to review and update the plan would be \$32.24 ($0.4 \times \80.61 per affected employee) for years 2-10.

Finally, OSHA estimated 5 minutes of clerical time each year per employee for providing each employee with a copy of the written exposure control plan. This will not change under this

rule, so there are no cost savings for this element. See Table IV-11 for a summary of these unit cost saving estimates.

Table IV-11: Unit Cost Savings for Written Exposure Control Plan

Item	Value
Develop Plan	
HR Manager Hour Decrease per Establishment	4
HR Manager Hour Decrease per Employee	0.25
HR Manager Wage	\$80.61
Unit Cost Savings per Establishment	\$322.44
Unit Cost Savings per Employee	\$20.15
Review Plan	
HR Manager Hour Decrease per Employee	0.10
Times Reviewed per Year	4
HR Manager Wage	\$80.61
Unit Cost Savings per Employee	\$32.24
Total	
Unit Cost Savings per Establishment	\$322.44
Unit Cost Savings per Employee	\$52.39

Sources: BLS, 2020a; BLS, 2018; US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

OSHA estimates that the total annualized cost savings for reducing the requirements for development and update of a written exposure control plan is \$126,668 for all affected industries in shipyards and construction.

In addition, OSHA is revising paragraph (f)(2) concerning engineering and work practice controls by removing the requirement to implement one engineering or work practice control where exposures are between the action level and the PEL. However, based on the technological feasibility analysis presented in Chapter IV of the 2017 FEA, OSHA determined that there were no instances in construction or shipyards where this provision would apply (see Document ID 2042, Chapter V, pp. V-11 to V-12). Thus, this revision has no effect on costs.

OSHA is not revising paragraph (f)(3), which prohibits rotation of workers to achieve the TWA PEL and STEL, so there are no cost savings associated with this provision.

OSHA is not revising the baseline compliance estimates for the requirements of paragraph (f), so there are no associated cost adjustments.

Respiratory Protection

Overview of Regulatory Requirements in the 2017 Final Rule

The employer must provide respiratory protection at no cost to the employee and ensure that each employee uses respiratory protection: during periods necessary to install or implement feasible engineering and work practice controls where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; during operations, including maintenance and repair activities and non-routine tasks, when engineering and work practice controls are not feasible and airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; during operations for which an employer has implemented all feasible engineering and work practice controls when such controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL; during emergencies; and when an employee who is eligible for medical removal under paragraph (l)(1) chooses to remain in a job with airborne exposure at or above the action level, as permitted by paragraph (l)(2)(ii) of this standard.

The selection and use of such respiratory protection must be in accordance with the Respiratory Protection standard (29 CFR 1910.134). The employer must provide at no cost to the employee a powered air-purifying respirator (PAPR) instead of a negative pressure respirator when respiratory protection is required, an employee requests one, and the PAPR would provide adequate protection to the employee.

Cost Savings Estimates of this Rule

Changes from the 2017 FEA

OSHA is revising paragraph (g) by removing the requirement to provide respiratory protection during emergencies. In the 2017 final rule, OSHA stated that emergencies should be rare and therefore did not account for any respirator costs due to emergencies. The cost adjustments described in this section are due to revised baseline compliance estimates from the 2019 PEA and are discussed below.

Updated baseline compliance estimates

As discussed in section IV.B of this FEA, the compliance rate for respirator use, for abrasive blasting operators only, is estimated to be 100 percent in this FEA, due to closer analysis of existing standards for operators. The 2017 FEA estimated compliance rates for respirators for all abrasive blasting occupations as 75 percent. Hence, there is a cost adjustment due to the 25 percent of operators who will not need to be provided respirators as estimated under the 2017 final rule. For pot tenders and helpers, OSHA is not estimating a change in the compliance rate for respiratory protection. For welders in shipyards, the change in the exposure profile from the 2017 FEA to the 2017 PEA (as explained above in section IV.B.), and retained in this FEA, slightly decreased respirator use as well. The 2017 FEA estimated a 0 percent compliance rate for respiratory protection and a 25 percent compliance rate for setting up a respiratory protection program, while this FEA estimates a 100 percent compliance rate for both. The 2017 FEA estimated 29.7 percent of welders in shipyards had beryllium exposures over the new PEL of $0.2 \mu\text{g}/\text{m}^3$. The 2017 PEA and this FEA estimate that only 3.7 percent of welders in shipyards have beryllium exposures over the new PEL of $0.2 \mu\text{g}/\text{m}^3$. As in the 2017 FEA, OSHA

is estimating that the beryllium standards will reduce the number of workers with exposures above the PEL by 90 percent.

The cost method that follows is largely the same as that used in the 2017 FEA with updated 2019 wage rates based on BLS data and the GDP implicit price deflator, with two exceptions. First, blasting operators, due to other existing standards (§§1926.57(f), 1915.34(c)), must use supplied air respirators (SARs) and will not have the option of requesting a PAPR. Second, no cleaning costs for a PAPR were estimated in the 2017 FEA. This is revised below because OSHA now estimates that PAPRs will need to be cleaned periodically.

Unit Cost Estimates

There are five primary costs for respiratory protection. First, there is a cost per establishment to set up a written respirator program in accordance with the respiratory protection standard (29 CFR 1910.134). The respiratory protection standard requires written procedures for the proper selection, use, cleaning, storage, and maintenance of respirators. OSHA estimates that these procedures will take a human resources manager 8 hours to develop, at an hourly wage of \$80.61 (Human Resources Managers, SOC: 11-3121), for an initial cost of \$645 (8 x \$80.61). Every year thereafter, OSHA estimates that the same employee will take 2 hours to update the respirator program, for an annual cost of \$161 (2 x \$80.61).

The four other major costs of respiratory protection are the per-employee costs for all aspects of respirator use: equipment, training, fit testing, and cleaning.

In the 2017 FEA, no respirator cleaning was assumed to be required for PAPRs. OSHA explained in the 2019 PEA that the agency now believes that despite the fact that PAPRs are assigned to individual employees, PAPRs, like half-mask respirators, will need periodic cleaning

(84 FR at 53934). No commenter challenged this determination and the agency is including the cost for respirator cleaning in this FEA.

This cleaning cost for a PAPR is estimated to be the same as for a half mask respirator. Periodic cleaning of a PAPR is estimated to be needed every two days, or 125 times annually (250/2). Each cleaning is estimated to take 5 minutes, or 0.08 (5/60) hours, and the wage cost per hour is \$25.92 (Production Occupations, SOC: 51-0000). Multiplied together, this gives an annual respirator cleaning cost of \$270.03 (125 x 0.08 x \$25.92). Summing these costs together, the total annualized per-employee cost for a full-face powered air-purifying respirator is \$1460.01 (\$147.87 + \$96.03 + \$946.08 + \$270.03).

Cost Savings Estimates

In the 2017 FEA, OSHA estimated that PAPRs would be used 10 percent of the time in situations where only the APF of 10 provided by a half-mask negative pressure respirator would normally be required to comply with the final beryllium TWA PEL and STEL. For the 25 percent of pot tenders and clean-up workers who need respirators (accounting for an unchanged baseline compliance rate of 75 percent), this amounts to 2.5 percent of the pot tenders and clean-up workers who are still exposed over the PEL after the standards take effect who will use PAPRs. OSHA is therefore adjusting the costs by including the cost of cleaning PAPRs for that 2.5 percent of workers.

For the revised compliance rate for abrasive blasting operators, from 75 percent in the 2017 FEA to 100 percent in this FEA, there is a cost adjustment due to the 25 percent of overexposed operators after the standards take effect who should not have had costs taken in the 2017 FEA. Since the 2017 FEA did not estimate cleaning costs for PAPRs, the cost savings here will not include such cleaning costs. This cost savings consists of the cost of PAPRs minus

cleaning costs (10 percent of respirators), and the cost of half-mask respirators (90 percent of respirators).

The cost adjustment due to the change in the exposure profile for welders discussed in section IV.B of this FEA uses this same methodology of accounting for savings due to PAPRs (minus cleaning costs) and half-mask respirators. Furthermore, OSHA notes there is a change in the exposure profile for welders in shipyards from the 2017 FEA, but because the revised baseline compliance rate for these workers is 100 percent, this does not affect the cost adjustment.

The exposure profile (Table IV-2) shows the number of abrasive blasting operators that are above the 0.2 $\mu\text{g}/\text{m}^3$ PEL. This FEA follows the 2017 FEA of estimating 10 percent of workers will still be above the PEL after the standards take effect. The compliance rate for operators went from 75 percent in the 2017 FEA to 100 percent in this FEA, so 25 percent of operators above the PEL after the rule is in place were assigned costs in the 2017 FEA that, with the 100 percent compliance rate, should no longer be taken. In the 2017 FEA, OSHA estimated the average cost of a respirator for an abrasive blasting operator as 90 percent of the cost of a half-mask respirator and 10 percent of a PAPR. For the abrasive blasting operators above the PEL, this gives a total cost adjustment of \$41,507.

As discussed above, 2.5 percent of pot-tenders and clean-up workers still exposed above the PEL after the standards take effect will be using PAPRs. The total number of such workers can be found in Table IV-2, and when multiplied by cleaning costs of PAPRs, this gives an additional cost adjustment of \$12,556 for the revision from the 2017 FEA of including cleaning costs for PAPRs for these workers.

Welders in shipyards were inadvertently assigned a 0 percent compliance rate in the 2017 FEA, revised in this FEA to 100 percent. Hence all welders in shipyards, found in Table IV-2, will be affected. Like all others needing respirators, in the 2017 FEA, 90 percent were assigned half-mask respirators and 10 percent were assigned PAPRs. These two groups of welders, multiplied by the costs of their respective type of respirators (minus the cleaning costs that were not accounted for in the 2017 FEA), gives a cost adjustment of \$871 for welders in shipyards.

The reduction in workers needing respirators and needing to participate in respiratory protection programs due to the update of the compliance rate for abrasive blasting operators in both construction and shipyards and welders in shipyards, the extra cleaning costs for pot-tenders and clean-up workers who opt for PAPRs, and the updated unit costs, together give a total cost adjustment of \$54,934, as shown in Table IV-16.

Tables IV-12 and IV-13 summarize the unit cost estimates for the two types of respirators.

Table IV-12: Unit Respiratory Protection Cost per Employee

Item	Value	
	Half Mask	PAPR
Training		
Class size	4	4
Hours	2	4
Employee wage	\$25.92	\$25.92
Supervisor wage	\$44.18	\$44.18
Hourly cost per employee	\$36.97	\$36.97
Annual Cost Savings per Employee	\$73.94	\$147.87
Respirator Cleaning Cost Savings		
Frequency per year	125	125
Employee hours	0.08	0.08
Employee wage	\$25.92	\$25.92
Annual Cost Savings per Employee	\$265.30	\$270.03
Fit Testing		
Testing group size	4.00	2.00
Employee hours	1.00	2.00
Employee wage	\$25.92	\$25.92
Supervisor wage	\$44.18	\$44.18
Annual Cost Savings per Employee	\$36.97	\$96.03
Equipment Cost		
Respirator	\$34.28	\$988.31
Respirator service life (years)	2	3
Annualized respirator cost savings (3%)	\$17.91	\$349.40
Annual accessory cost savings	\$214.15	\$596.68
Total Annualized Equipment Cost Savings (3%)	\$232.06	\$946.08
Total		
Equipment	\$232.06	\$946.08
Training, cleaning, and fit testing	\$376.21	\$513.93

Note: Figures in rows may not add to totals due to rounding.

Sources: BLS, 2020a; BLS, 2018; Magidglove, 2012; Grainger, 2012e; Restockit, 2012; Spectrumchemical, 2012; Conney, 2012a; Conney, 2012b; Zoro Tools, 2012a; Grainger, 2019c; Grainger, 2019d; Advanz Lens Goggles, 2019; Gemplers, 2012; Buying Direct, 2012; Amazon.com, 2013; Zoro Tools, 2013; Grainger, 2013b; EnviroSafety Products, 2013; BEA, 2020; US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250); Grainger, 2019a; Grainger, 2019b.

Table IV-13: Half-Mask and Powered Air Purifying Respirator (PAPR) Unit Cost		
	Half- Mask	PAPR
Respirator		
Respirator	\$34.28	\$988.31
Annual Costs		
Training	\$73.94	\$147.87
Cleaning	\$265.30	\$270.03
Fit Testing	\$36.97	\$96.03
Accessories	\$214.15	\$596.68
Annual Subtotal	\$590.36	\$1,110.61
Annualized Costs		
Years	2	3
Annualized Unit Cost (3%)	\$608.27	\$1,460.00
Annualized Unit Cost (7%)	\$609.31	\$1,487.20

Sources: Magidglove, 2012; Grainger, 2012e; Restockit, 2012; Spectrumchemical, 2012; Conney, 2012a; Conney, 2012b; Zoro Tools, 2012a; Grainger, 2019c; Grainger, 2019d; Advanz Lens Goggles, 2019; Gemplers, 2012; Buying Direct, 2012; Amazon.com, 2013; Zoro Tools, 2013; Grainger, 2013b; EnviroSafety Products, 2013; Grainger, 2019a; Grainger, 2019b.

Personal Protective Clothing and Equipment

Overview of Regulatory Requirements in the 2017 Final Rule

Under the 2017 final rule, personal protective clothing and equipment are required for workers in shipyards and construction where exposure exceeds or can reasonably be expected to exceed the TWA PEL or STEL, or where there is a reasonable expectation of dermal contact with beryllium.

The employer must ensure that each employee removes all beryllium-contaminated personal protective clothing and equipment at the end of the work shift, at the completion of all tasks involving beryllium, or when personal protective clothing or equipment becomes visibly contaminated with beryllium, whichever comes first. All such personal protective clothing and equipment must be removed as specified in the written exposure control plan. Personal protective clothing and equipment must be kept separate from street clothing and the employer must ensure that storage facilities prevent cross-contamination. The employer must ensure that personal

protective clothing and equipment is not removed from the workplace except by authorized personnel, with appropriate containers and labels that are in accordance with paragraph (m)(2). All reusable personal protective clothing and equipment must be cleaned, laundered, repaired, and replaced as needed.

The employer must ensure that beryllium is not removed from personal protective clothing and equipment by blowing, shaking, or any other means that disperses beryllium into the air. The employer must inform in writing the persons or the business entities who launder, clean, or repair the personal protective clothing or equipment required by this standard of the potentially harmful effects of airborne exposure to and dermal contact with beryllium and that the personal protective clothing and equipment must be handled in accordance with this standard.

Cost Savings Estimates of this Final Rule.

OSHA is making several revisions to the PPE provisions of the standards. OSHA is removing the requirements regarding storage facilities, providing PPE based on an expectation of dermal contact with beryllium, removal of PPE when it becomes visibly contaminated with beryllium, storing and keeping PPE separate from employees' street clothing, removal of beryllium-contaminated PPE from the workplace, and transportation and labeling of PPE that is removed from the workplace. OSHA is also removing the qualifier "beryllium-contaminated" and replacing it with "required by this standard." A further change from the proposed rule is that OSHA is also adding a provision that states the employer must ensure that no employee with reasonably expected exposure above the TWA PEL or STEL removes personal protective clothing and equipment required by the beryllium standard from the workplace unless it has been cleaned in accordance with paragraph (h)(3)(ii). The 2017 FEA, and the 2019 PEA, estimated that employers would rent rather than buy PPE. The agency continues to estimate this will be the

common approach, with any cases due to this last provision having a negligible effect on costs.

Under these changes, the PPE provisions will only apply to employees who are, or can reasonably be expected to be, exposed over the TWA PEL or STEL. In the 2017 FEA, OSHA also estimated PPE costs for the 25 percent of employees who would be exposed below the PEL but who nevertheless may have dermal contact with beryllium. OSHA also estimated ten minutes of clerical time for each establishment with laundry needs to notify the cleaners in writing of the potentially harmful effects of beryllium exposure and how the protective clothing and equipment must be handled in accordance with the beryllium standard, so the removal of that provision will result in a cost savings. OSHA did not estimate costs for extra storage facilities because it judged that no employers would need them.

As stated in the compliance section in IV.B, above, OSHA estimates a 90 percent compliance rate for all PPE for workers who have exposures above the TWA PEL or STEL. This is a change from the 2017 FEA, which estimated a 75 percent compliance rate for PPE for all workers, not just those exposed above the TWA PEL or STEL. This results in two cost effects. First, there is an adjustment to costs due to the decreased number of workers, from 25 percent to 10 percent, with exposures above the TWA PEL or STEL who will need PPE. The exposure profile (Table IV-2) shows the number of workers who are exposed above the 0.2 $\mu\text{g}/\text{m}^3$ PEL. For those above the PEL, the 15 percent decrease in the compliance rate from 25 percent to 10 percent, along with OSHA's standard calculation that 10 percent of those workers will continue to be exposed above the PEL after the standards take effect, means 1.5 percent of these workers will no longer need PPE. This number of workers times the unit costs (discussed below) gives the cost adjustment for this group. Second, for those workers whose exposures are below the TWA PEL and STEL, there will also be a cost savings for the 25 percent that the 2017 FEA

estimated did not have proper PPE, due to the removal of the dermal contact trigger for PPE. The exposure profile (Table IV-2) shows the number of workers below the PEL. OSHA is revising the compliance rate from 75 percent to 100 percent because the PPE provisions are no longer required for those below the TWA PEL and STEL, so 25 percent will no longer need PPE. This number of workers times the unit costs (discussed below) gives the cost savings for this group.

The cost savings due to the removal of the requirement to notify laundries is per-establishment, not per-worker, and the number of establishments can be found in Table IV-4. The total number of affected establishments times the cost of clerical time, below, gives the cost savings for this revision.

In the 2017 FEA, OSHA estimated that employers would rent rather than purchase PPE. The annual cost for rental would be \$54.62 per employee, inflated from the 2017 FEA estimate of \$48.62. The per-establishment annual cost savings for the ten minutes of clerical time required to notify laundries is \$4.12 (\$24.76 hourly wage, File Clerks, SOC: 43-4071).

After accounting for the 25 percent of employees who no longer need PPE due to the removal of the dermal contact trigger, the change in the compliance rate from 75 percent to 90 percent, and the removal of the ten minutes of clerical time for notifying laundries, the total annualized cost savings and adjustment for the revisions to the PPE paragraph is estimated to be \$167,196 at a 3 percent discount rate.

Hygiene Areas and Practices

Overview of Regulatory Requirements in the 2017 Final Rule

The 2017 final rule requires affected shipyard and construction employers to provide readily accessible washing facilities to remove beryllium from the hands, face, and neck of each employee exposed to beryllium; ensure that employees who have dermal contact with beryllium

wash any exposed skin at the end of the activity, process, or work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet; and provide employees required to use PPE with a designated change room where employees are required to remove their personal clothing. Wherever the employer allows employees to consume food or beverages at a worksite where beryllium is present, the employer must ensure that surfaces in eating and drinking areas are as free as practicable of beryllium and no employees enter any eating or drinking area with personal protective clothing or equipment unless, prior to entry, surface beryllium has been removed from the clothing or equipment by methods that do not disperse beryllium into the air or onto an employee's body. The employer must also ensure that no employees eat, drink, smoke, chew tobacco or gum, or apply cosmetics in work areas where there is a reasonable expectation of exposure above the TWA PEL or STEL.

Cost Savings Estimates in this Rule

OSHA is rescinding this paragraph in its entirety. Both washing facilities and change rooms would no longer be directly required under this rule. However, because PPE is still required where airborne beryllium exceeds the TWA PEL or STEL, employers will still need to provide change rooms where exposures are above the TWA PEL or STEL pursuant to the sanitation standards.

The 2017 FEA estimated no costs for readily accessible washing facilities, under the expectation that employers already have such facilities in place where needed, and this FEA retains this estimate. Therefore, OSHA is estimating no cost savings from washing facilities due to this rule. The 2017 FEA did include costs for disposable head coverings that would be purchased for processes where hair may become contaminated by beryllium. Employers in construction and shipyards will not incur these costs under the existing standards because unlike

in general industry, there are no requirements in construction or shipyards to provide showers where hair can become contaminated with beryllium. OSHA is therefore making a cost adjustment to account for this. The annual cost for one disposable head covering per day in 2019 dollars is \$31.32 (Grainger, 2013). The number of workers estimated to need such head coverings in the 2017 FEA is 542; so the total annual cost adjustment is \$16,975 ($\31.32×542).

The agency is not estimating cost savings for the removal of requirements to add a change room and segregated lockers. The sanitation standards (29 CFR 1926.51 and 29 CFR 1915.88) require employers to provide change rooms whenever they require employees to wear PPE to prevent exposure to hazardous or toxic substances. Under this rule, employers would still be required by the sanitation standards, combined with the PEL requirements in the 2017 beryllium final rule, to provide PPE to employees to prevent exposure to beryllium. Therefore, no cost savings would arise from this change.

The revisions to the PPE paragraph would remove the need for employees to change out of PPE, generally at the end of a shift, for those not exposed to airborne beryllium above the TWA PEL and STEL. In the 2017 FEA, OSHA included the cost of changing clothes in the costs for the hygiene provisions rather than the PPE provisions. The cost for a clothing change is the same as in the 2017 FEA, updated to 2018 dollars. The agency expected that, in many cases, a worker will simply be adding, and later removing, a layer of clothing (such as a lab coat, coverall, or shoe covers) at work, which might involve no more than a couple of minutes a day. However, in other cases, a worker may need a full clothing change. Taking all these factors into account, OSHA estimated that a worker using PPE would need 5 minutes per day to change clothes (Document ID 2042, p. V-185). The annual cost per employee to change clothes is \$540.06. This cost is based on a production worker earning \$25.92 an hour (Production

Occupation, SOC: 51-0000) and taking 5 minutes per day to change clothes for 250 days per year $((5/60) \times \$25.92 \times 250)$.

OSHA's removal of the eating and drinking areas and prohibited activities provisions of paragraph (i) have cost implications only for training, which is discussed later in this cost section.

The agency estimates the total annualized cost savings of the removal of paragraph (i) to be \$309,464 for all affected establishments. The breakdown of these cost savings by NAICS code can be seen in Table IV-15 at the end of this program cost-savings section.

Housekeeping

Overview of Regulatory Requirements in the 2017 Final Rule

The housekeeping provisions require the employer to follow the written exposure control plan when cleaning beryllium-contaminated areas, ensure that all spills and emergency releases of beryllium are cleaned up promptly and in accordance with the written exposure control plan required under paragraph (f)(1) of this standard. The provisions require the employer to ensure the use of HEPA-filtered vacuuming or other methods that minimize the likelihood and level of airborne exposure when cleaning beryllium-contaminated areas, and prohibit the employer from allowing dry sweeping or brushing for cleaning in such areas unless HEPA-filtered vacuuming or other methods that minimize the likelihood and level of airborne exposure are not safe or effective. The provisions also prohibit the employer from allowing the use of compressed air for cleaning in beryllium-contaminated areas unless the compressed air is used in conjunction with a ventilation system designed to capture the particulates made airborne by the use of compressed air. Where employees use dry sweeping, brushing, or compressed air to clean in beryllium-contaminated areas, the employer must provide, and ensure that each employee uses, respiratory

protection and personal protective clothing and equipment in accordance with paragraphs (g) and (h) of the standards. The employer must also ensure that cleaning equipment is handled and maintained in a manner that minimizes the likelihood and level of airborne exposure and the re-entrainment of airborne beryllium in the workplace. When the employer transfers materials containing beryllium to another party for use or disposal, the employer must provide the recipient with the warning required by paragraph (m).

Cost Savings Estimates in this Rule

OSHA is removing the requirements to follow the written exposure control plan when cleaning and to promptly clean up spills and emergency releases. OSHA is also revising the cleaning methods requirements to remove the reference to HEPA-filtered vacuuming and to trigger these provisions on the presence of dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL, rather than on the presence of a “beryllium-contaminated area.” In addition, OSHA is removing the qualifier “in beryllium-contaminated areas” from the requirement to provide PPE and respiratory protection in accordance with other provisions in the standards. Next, OSHA is prohibiting the use of compressed air for cleaning where the use of compressed air causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL. Finally, OSHA is removing the requirement to provide a warning when transferring materials containing beryllium to another party for use or disposal.

The agency is estimating cost savings for removing the requirement to use HEPA-filtered vacuums for shipyards and construction and for removing the need for a warning label when transferring materials containing beryllium to another party for use or disposal. The other cost included for this provision is labor time spent doing housekeeping tasks, and the agency

estimates the revisions do not alter its 2017 FEA estimate of an additional 5 minutes per day for each employee.

In the 2017 FEA, OSHA estimated a compliance rate for the housekeeping provisions of 75 percent for all workers in abrasive blasting based on the agency's determination that other standards required some housekeeping for abrasive blasting in both construction and shipyards. As discussed above, a further review of other standards has led the agency to revise its compliance rate for housekeeping to 100 percent. While the revisions will limit the methods that employers may use to clean up beryllium, OSHA estimates that cleaning methods which do not disperse beryllium into the air take approximately the same amount of time as cleaning methods already in use. OSHA is making a cost adjustment in this FEA, maintaining the change in the 2019 PEA, for the additional 25 percent of workers in abrasive blasting operations who are now estimated to be performing housekeeping tasks. Furthermore, while those areas that are below the TWA PEL and STEL no longer have any requirements for housekeeping tasks, OSHA is not estimating an additional cost savings because its revised compliance estimate is already at 100 percent. OSHA estimated in the 2017 FEA that welding in shipyards had a 0 percent compliance rate for housekeeping. This has also been changed to 100 percent compliance in this FEA, as explained in section IV.B of this FEA. OSHA is also making a cost adjustment for this change in the compliance rate.

OSHA estimated the following costs for the housekeeping provisions in the 2017 FEA (Document ID 2042, pp. V-187-190, amounts adjusted for 2019 dollars): a one-time annualized cost per worker of a HEPA-filtered vacuum (\$652); the annual cost per worker of the additional time needed to perform housekeeping (\$540); and the annual cost of the warning labels per worker (\$6). The total annual per-employee cost was \$1,197 (\$652+\$540+\$6). This per-

employee cost is then multiplied by the 25 percent of workers in abrasive blasting operations and 100 percent of the welders who are now estimated to be in compliance versus the 2017 FEA to calculate the cost adjustment due to the revised baseline compliance rates.

The total annualized cost adjustment in this rule due to revisions to this ancillary provision are \$1,764,878. The breakdown of these cost savings by NAICS code is shown in Table IV-15 at the end of this program cost-savings section.

Medical Surveillance

Overview of Regulatory Requirements in the 2017 Final Rule

The 2017 final rule requires affected employers in shipyards and construction to make medical surveillance available at a reasonable time and place, and at no cost, to the following employees:

1. Employees who are, or are reasonably expected to be, exposed at or above the action level for more than 30 days per year;
2. Employees who show signs or symptoms of chronic beryllium disease (CBD) or signs or symptoms of other beryllium-related health effects;
3. Employees exposed to beryllium during an emergency; and
4. Employees whose most recent written medical opinion required by this standard recommends periodic medical surveillance.

The medical surveillance paragraph also specifies the frequency with which examinations must be provided, the required contents of the examination, the information that the employer must provide to the physician or other licensed healthcare provider (PLHCP), the information that must be contained in the physician's written medical report for the employee, the information that must be contained in the physician's written medical opinion for the employer, and

procedures and requirements related to referral to a CBD diagnostic center.

Cost Savings of this Rule

OSHA is making minor changes to the medical surveillance provision of the 2017 final rule. In response to the 2019 NPRM, the agency received one comment on its medical exam costs estimates. Referring to comments it had previously submitted, NABTU reiterated its prior assessment of medical exam costs: “\$216 is for shipping of specimen and lab analysis. In a standalone situation an additional charge would be for blood draw, which we estimate to be about \$20.00” (Document ID 2236, p. 2). Because NABTU’s initial comments were reviewed and incorporated into the 2017 FEA and their subsequent comment indicates the estimates are generally unchanged, OSHA is not altering any of the unit costs from the 2017 FEA, including these medical surveillance costs.

First, OSHA is removing the emergency trigger for medical surveillance. The 2017 FEA did not break out a separate cost for emergencies, stating that “a very small number of employees will be affected by emergencies in a given year” (Document ID 2042, Chapter V, p. V-196). The agency therefore concludes that removing the emergency trigger will result in de minimis cost savings.

OSHA is also modifying the language in paragraph (k)(2)(iii) to match the General Industry standard. This modification adds more detail regarding requirements for a medical examination at the termination of an employee’s employment and is meant to clarify who will receive such an exam. The agency does not expect this to significantly change the number of exams performed and judges it to have de minimis cost implications.

OSHA also is replacing from the 2017 standards the phrase “airborne exposure to and dermal contact with beryllium” in these provisions with the simpler phrase “exposure to

beryllium.” As explained in the Summary and Explanation section, this is not a substantive change and has no cost implications.

OSHA proposed a change to the definition of *CBD diagnostic center* to clarify that a center must have a pulmonologist or pulmonary specialist on staff and must be capable of performing a variety of tests commonly used in the diagnosis of CBD, but need not necessarily perform all of the tests during all CBD evaluations. The 2016 FEA did not estimate that all tests would be performed during all CBD evaluations, so the agency takes no cost savings for this change. In response to comments received and to align with changes made in the July 14, 2020 general industry final rule (85 FR 42582), OSHA is further modifying the language of this definition from the language proposed in the 2019 NPRM. Specifically, rather than requiring CBD diagnostic centers to have a pulmonary specialist on site, the definition now specifies that centers must have one on staff. Also, rather than stating that each evaluation must include pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy, the definition now states that CBD diagnostic centers must have the capacity to perform such tests. Because the 2017 FEA for a medical examination at a CBD diagnostic center costed the typical tests given by a CBD diagnostic center, these changes have no effect on costs (see Document ID 2042, Chapter V, p. V-204)

OSHA is amending paragraph (k)(7)(i) to require that the employer must provide, at no cost to the employee and at a CBD diagnostic center that is mutually agreed upon by the employer and employee, an evaluation at the CBD diagnostic center that must be scheduled within 30 days, and must occur within a reasonable time. The 2017 beryllium standards required

the actual evaluation to take place within 30 days. This change to paragraph (k)(7) allows increased flexibility in scheduling and may lead to minor cost savings.

In the 2019 NPRM, OSHA proposed that the employer provide an initial consultation with the CBD diagnostic center, rather than the full evaluation, within 30 days of the employer receiving notice that a full evaluation must be performed. This initial consultation could be done in conjunction with the tests but it was not required to be. As the initial consultation could be conducted remotely, by phone or virtual conferencing, the cost of the consultation would consist only of time spent by the employee and the PLHCP and would not have to include any travel or accommodation.

In the 2017 FEA, OSHA accounted for the cost of both the employee's time and the local examining physician's time for a 15-minute discussion (2017 FEA, Chapter V, p. V-206). The 2019 PEA concluded that because the consultation at the CBD diagnostic center would replace this initial discussion, there would be no additional cost.

In this final rule, OSHA is not adopting the proposed requirement for an initial consultation with the CBD diagnostic center. Since in the economic analysis the initial consultation was a replacement for a discussion with a local PLCHP, the removal of this requirement will have no change in costs: there will still be the discussion with the local PLCHP with the same unit cost.

OSHA is making another change from the requirements for the CBD diagnostic center examination as proposed in the 2019 NPRM. In this final rule, OSHA has clarified that, if the examining physician at the CBD diagnostic center recommends a test that is not available at that center, the test may instead be performed at another location that is mutually agreed upon by the employer and the employee. In terms of the cost impact of this change, it will allow more

flexibility in identifying a location for tests and may allow employers to find more economical travel and accommodation options. The change also aligns the construction and shipyards standards to changes made in the July 14, 2020 general industry final rule. The agency concludes these changes would produce minor, if any, cost savings, and no additional costs.

Another proposed change with potential implications for medical surveillance costs is a proposed change in the definition of *confirmed positive*. The 2019 NPRM proposed to clarify that confirmed positive means the person tested has had two abnormal BeLPT test results, an abnormal and a borderline test result, or three borderline test results obtained within the 30-day follow-up test period after a first abnormal or borderline BeLPT test result. Unlike the 2017 standards, the proposed change explicitly required that the qualifying test results be obtained within one testing cycle (including the 30-day follow-up test period required after a first abnormal or borderline BeLPT test result), rather than arguably over an unlimited time period. The 2019 NPRM explained that some stakeholders had construed the 2017 final rule to allow these tests to cumulate over an unlimited time period though this was not the agency's intent. OSHA explained in the 2019 PEA that the exact effect of this proposed change was uncertain, as it is unknown how many employees would have a series of BeLPT results associated with a confirmed positive finding (two abnormal results, one abnormal and one borderline result, or three borderline results) over an unlimited period of time, but would not have any such combination of results within a single testing cycle.

OSHA received several comments discussing the practicality of the provisions relating to the 30-day testing cycle (Document ID 2208, 2211, 2213, 2237, 2243, and 2244). These comments are discussed in the summary and explanation for paragraph (b). After reviewing the comments and record, OSHA has further modified the definition of *confirmed positive* in this

final rule from the definition proposed in the 2019 NPRM. In this final rule, OSHA is requiring that the set of tests that demonstrate confirmed positive must be from tests conducted within a 3-year period. This change aligns with similar revisions made in the July 14, 2020 general industry final rule. As in the PEA in support of the 2018 proposed revisions to the general industry standard, OSHA concludes that this change would not increase compliance costs and would incidentally yield some cost savings by lessening the likelihood of false positives.

Other changes are to align these standards with the (proposed) general industry standard and, similar to the economic analysis there, are also estimated to only have de minimis effects on costs.

Medical Removal

OSHA is not making any changes to paragraph (l), Medical removal protection. OSHA is also not making any changes to the baseline compliance rate with this paragraph. Therefore, there are no cost savings associated with this provision.

Communication of Hazards

Overview of Regulatory Requirements in the 2017 Final Rule

Paragraph (m) of the beryllium standards for construction and shipyards sets forth the employer's obligations to comply with OSHA's Hazard Communication Standard (HCS) (29 CFR 1910.1200) relative to beryllium, and to provide warnings and training to employees about the hazards of beryllium.

Cost Savings in this Rule

OSHA is making three changes to paragraph (m) in both the construction and shipyards standards. First, OSHA is removing the paragraph (m) provisions that require specific language for warning labels applied to materials designated for disposal or PPE when removed from the

workplace ((m)(2) in construction and (m)(3) in shipyards). This is consistent with OSHA's modification to remove the corresponding requirements to provide such warning labels and any cost implications are accounted for in the sections on those corresponding provisions.

Second, OSHA is revising paragraphs (m)(3)(i) in construction and (m)(4)(i) in shipyards—renumbered as (m)(2)(i) and (m)(3)(i), respectively—to remove dermal contact as a trigger for training in accordance with the HCS (29 CFR 1910.1200(h)). As explained in the summary and explanation for paragraph (m), because OSHA judges that there are no workers who would have received training solely due to the potential for dermal contact, the agency has determined that the HCS training requirements will continue to apply to all workers that are covered under the construction and shipyards standards. Regardless, for purposes of its economic analysis, OSHA did not include in the 2017 FEA costs associated with training under the HCS. Accordingly, OSHA expects no cost implications from this change.

Third, OSHA is revising the provisions of paragraph (m) for employee information and training related to emergency procedures ((m)(3)(ii)(D) in construction and (m)(4)(ii)(D) in shipyards) and personal hygiene practices ((m)(3)(ii)(E) in construction and (m)(4)(ii)(E) in shipyards), for consistency with OSHA's removal of emergency procedures and personal hygiene practices from the construction and shipyards standards. OSHA estimates that this change will lead to cost savings.

Below the agency first presents the methodology for training from the 2017 final rule with unit cost estimates updated to 2018 dollars, and then discusses and estimates the cost effects of this rule.

In the 2017 FEA, OSHA estimated that training, which includes hazard communication training, would be conducted by in-house safety or supervisory staff with the use of training

modules and videos and would last, on average, eight hours. (Note that this estimate does not include the time taken for hazard communication training that is already required by 29 CFR 1910.1200). The agency judged that establishments could purchase sufficient training materials at an average cost of \$2.21 per worker, encompassing the cost of handouts, video presentations, and training manuals and exercises. For initial and periodic training, OSHA estimates an average class size of five workers (each at a wage of \$25.92 (updated from Production Occupations, SOC: 51-0000)) with one instructor (at a wage of \$42.19 (Median Wage for Training and Development Specialists, SOC: 13-1151)) over an eight hour period. The per-worker cost of initial training is therefore \$277.07 $((8 \times \$25.92) + (8 \times \$42.19/5) + \$2.21)$.

Annual retraining of workers is also required by the standards. OSHA estimates the same unit costs as for initial training, so retraining would require the same per-worker cost of \$277.07.

The first type of cost savings comes from changes to the training provision itself, where the rule rescinds the requirement to train employees on emergency procedures. The agency estimates that this will decrease training time by 15 minutes. Other decreases in training time come from rescinded portions of hygiene requirements, including: washing areas, change rooms, eating and drinking areas, and cross-contamination. The agency estimates that this would decrease needed training by another hour.

Together this would decrease the required per-employee training from 8 hours to 6.75 hours. Hence, the per-worker cost of initial and retraining is \$234.13 $((6.75 \times \$25.92) + (6.75 \times \$42.19/5) + \$2.21)$.

Finally, using these unit cost estimates, as well as accounting for industry-specific baseline compliance rates (which, as explained in section IV.B of this FEA, are unchanged from the 2017 FEA), and based on a 31.8 percent new hire rate (BLS 2020b, using the annual

manufacturing new hire rate, as was done in the 2017 FEA, updated to the current rate), OSHA estimates that the revisions to the training requirements in the standards would result in an annualized total cost savings of \$103,276. The breakdown of these cost savings by NAICS code is shown in Table IV-15 at the end of this program cost-savings section.

Familiarization Costs

In the 2017 final rule, OSHA included familiarization costs to account for employers’ time taken to understand the new standards. The changes that OSHA is making to most provisions in this final rule are not extensive. Employers will thus only need to spend a brief amount of time to review them. In the 2019 PEA, OSHA estimated that employers would spend one hour per firm reviewing the changed requirements. As this final rule results in minor distinctions from the 2019 proposed rule, OSHA continues to estimate employers will spend an hour per firm reviewing the changed requirements.

Table IV-14 shows the unit costs, by establishment size, of reviewing the changes in this rule. These costs will likely be one-time costs incurred during the first year after the effective date of a final rule resulting from this rule, but the aggregate costs are annualized for consistency with the other estimates for this rule. Based on the unit familiarization (negative) cost savings in Table IV-14, the total annualized familiarization costs of this rule are estimated to be \$14,480. The breakdown of these costs by NAICS code is in Table IV-15 at the end of this program cost-savings section, and these costs are reflected in the tables as a negative cost savings.

Table IV-14: Familiarization - Construction and Shipyard Assumptions and Unit Cost Savings

Item	Establishment Size (Employees)		
	Small (<20)	Medium (20-499)	Large (500+)
Hours per establishment	1.0	1.0	1.0
Total cost savings per establishment	-\$44.18	-\$44.18	-\$44.18
Annualized Cost Savings (3 Percent)	-\$5.18	-\$5.18	-\$5.18

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250)

Note: Figures in rows may not add to totals due to rounding.

Table IV-15: Annualized Cost Savings of Program Requirements for Industries Affected by the Beryllium Standard by Sector and Six-Digit NAICS Industry (in 2019 Dollars using a 3 Percent Discount Rate)

Application Group/NAICS	Industry	Rule Familiarization	Exposure Assessment	Regulated Areas/ Competent Person	Medical Surveillance	Medical Removal Provision	Written Exposure Control Plan	Protective Work Clothing & Equipment	Hygiene Areas and Practices	Housekeeping	Training	Total Program Cost Savings
Abrasive Blasting - Construction												
238320	Painting and Wall Covering Contractors	-\$5,646	\$0	\$0	\$0	\$0	\$48,022	\$63,055	\$117,715	\$665,231	\$38,933	\$927,311
238990	All Other Specialty Trade Contractors	-\$5,231	\$0	\$0	\$0	\$0	\$44,498	\$58,427	\$109,076	\$616,407	\$36,076	\$859,252
Abrasive Blasting - Shipyards												
336611a	Ship Building and Repairing	-\$3,569	\$0	\$0	\$0	\$0	\$32,985	\$44,176	\$82,617	\$466,882	\$27,325	\$650,416
Welding - Shipyards												
336611b	Ship Building and Repairing	-\$34	\$0	\$0	\$0	\$0	\$1,163	\$1,538	\$56	\$16,358	\$943	\$20,025
Total												
Construction Subtotal		-\$10,877	\$0	\$0	\$0	\$0	\$92,520	\$121,482	\$226,791	\$1,281,638	\$75,009	\$1,786,563
Maritime Subtotal		-\$3,603	\$0	\$0	\$0	\$0	\$34,148	\$45,714	\$82,673	\$483,241	\$28,267	\$670,441
Total, All Industries		-\$14,480	\$0	\$0	\$0	\$0	\$126,668	\$167,196	\$309,464	\$1,764,878	\$103,276	\$2,457,003

Note: Figures in rows may not add to totals due to rounding.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Total Annualized Cost Savings

As shown in Table IV-16, the total annualized cost savings of this rule, using a 3 percent discount rate, is estimated to be about \$2.5 million.

Table IV-16: Annualized Cost Savings to Industries Affected by the Beryllium Standard, by Sector and Six-Digit NAICS Industry (2019 Dollars, 3 Percent Discount Rate)

Application Group/ NAICS	Industry	Engineering Controls and Work Practices	Respirator Cost Savings	Program Cost Savings	Total Cost Savings
Abrasive Blasting – Construction					
238320	Painting and Wall Covering Contractors	\$0	\$20,740	\$927,311	\$948,051
238990	All Other Specialty Trade Contractors	\$0	\$19,218	\$859,252	\$878,469
Abrasive Blasting – Shipyards					
336611a	Ship Building and Repairing	\$0	\$14,106	\$650,416	\$664,522
Welding – Shipyards					
336611b	Ship Building and Repairing	\$0	\$871	\$20,025	\$20,896
Total					
Construction Subtotal		\$0	\$39,957	\$1,786,563	\$1,826,520
Maritime Subtotal		\$0	\$14,977	\$670,441	\$685,418
Total, All Industries		\$0	\$54,934	\$2,457,003	\$2,511,938

Note: Figures in rows may not add to totals due to rounding.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Time Distribution of Cost Savings

OSHA analyzed the stream of (un-annualized) compliance cost savings for the first ten years after the rule will take effect. As shown in Table IV-17, total compliance cost savings are expected to decline from year 1 to year 2 by almost half after the initial set of capital and program start-up expenditure savings has been incurred. Cost savings are then essentially flat with relatively small variations for the following years.

Table IV-17: Distribution of Undiscounted Compliance Costs and Cost Savings by Year (2019 Dollars)

Year	Program Cost Savings	Respirators	Engineering Controls	Rule Familiarization	Total
1	\$4,292,553	\$88,029	\$0	-\$123,515	\$4,257,066
2	\$2,217,400	\$46,790	\$0	\$0	\$2,264,190
3	\$2,217,400	\$48,491	\$0	\$0	\$2,265,891
4	\$2,217,400	\$52,241	\$0	\$0	\$2,269,641
5	\$2,217,400	\$48,491	\$0	\$0	\$2,265,891
6	\$2,217,400	\$46,790	\$0	\$0	\$2,264,190
7	\$2,217,400	\$53,942	\$0	\$0	\$2,271,342
8	\$2,217,400	\$46,790	\$0	\$0	\$2,264,190
9	\$2,217,400	\$48,491	\$0	\$0	\$2,265,891
10	\$2,217,400	\$52,241	\$0	\$0	\$2,269,641

Note: Figures in rows may not add to totals due to rounding.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Table IV-18 breaks out total cost savings by each application group for the first ten years. Each application group follows the same pattern of a sharp decrease in cost savings between years 1 and 2, and then remains relatively flat for the remaining years.

Table IV-18: Total Undiscounted Cost Savings of the Beryllium Standard by Year (2019 Dollars)

Application Group	Year									
	1	2	3	4	5	6	7	8	9	10
Abrasive Blasting - Construction	\$3,095,549	\$1,646,363	\$1,647,587	\$1,650,286	\$1,647,587	\$1,646,363	\$1,651,510	\$1,646,363	\$1,647,587	\$1,650,286
Abrasive Blasting - Shipyards	\$1,123,592	\$599,362	\$599,808	\$600,791	\$599,808	\$599,362	\$601,237	\$599,362	\$599,808	\$600,791
Welding - Shipyards	\$37,925	\$18,466	\$18,496	\$18,564	\$18,496	\$18,466	\$18,595	\$18,466	\$18,496	\$18,564
Total	\$4,257,066	\$2,264,190	\$2,265,891	\$2,269,641	\$2,265,891	\$2,264,190	\$2,271,342	\$2,264,190	\$2,265,891	\$2,269,641

Note: Figures in rows may not add to totals due to rounding.

Source: U.S. DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Appendix IV-A

Summary of Annualized Cost Savings by Entity Size under Alternative Discount Rates

In addition to using a 3 percent discount rate in its cost analysis, OSHA estimated compliance cost savings using alternative discount rates of 7 percent and 0 percent. Tables IV-19 and IV-20 present— for 7 percent and 0 percent discount rates, respectively—total annualized cost savings for affected employers by NAICS industry code and employment size class (all establishments, small entities, and very small entities).

As shown in these tables, the choice of discount rate has only a minor effect on total annualized compliance cost savings—for example, annualized cost savings for all establishments remain flat/slightly increase to \$2.6 million using a 7 percent discount rate, and remain flat/slightly decrease to \$2.5 million using a 0 percent discount rate.

Table IV-19: Total Annualized Cost Savings, by Sector and Six-Digit NAICS Industry, for Entities Affected by the Shipyard and Construction Beryllium Standards (By Size Category, 7 Percent Discount Rate, 2019 Dollars)

Application Group/ NAICS	Industry	All Establishments	Small Entities (SBA-defined)	Very Small Entities (<20 Employees)
Abrasive Blasting – Construction				
238320	Painting and Wall Covering Contractors	\$967,892	\$796,918	\$527,892
238990	All Other Specialty Trade Contractors	\$896,854	\$665,964	\$426,508
Abrasive Blasting – Shipyards*				
336611a	Ship Building and Repairing	\$678,347	\$175,887	\$88,164
Welding in Shipyards**				
336611b	Ship Building and Repairing	\$21,408	\$5,687	\$3,158
Total				
Construction Subtotal		\$1,864,746	\$1,462,882	\$954,400
Shipyard Subtotal		\$699,755	\$181,574	\$91,322
Total, All Industries		\$2,564,501	\$1,644,456	\$1,045,722

Note: Figures in rows may not add to totals due to rounding.

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

Source: U.S. DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Table IV-20: Total Annualized Cost Savings, by Sector and Six-Digit NAICS Industry, for Entities Affected by the Shipyard and Construction Beryllium Standards (By Size Category, 0 Percent Discount Rate, 2019 Dollars)

Application Group/ NAICS	Industry	All Establishments	Small Entities (SBA-defined)	Very Small Entities (<20 Employees)
Abrasive Blasting – Construction				
238320	Painting and Wall Covering Contractors	\$946,753	\$779,194	\$515,604
238990	All Other Specialty Trade Contractors	\$877,267	\$651,005	\$416,413
Abrasive Blasting – Shipyards*				
336611a	Ship Building and Repairing	\$663,659	\$171,313	\$85,760
Welding in Shipyards**				
336611b	Ship Building and Repairing	\$20,848	\$5,487	\$3,043
Total				
Construction Subtotal		\$1,824,020	\$1,430,199	\$932,017
Shipyard Subtotal		\$684,507	\$176,800	\$88,803
Total, All Industries		\$2,508,526	\$1,606,999	\$1,020,820

Note: Figures in rows may not add to totals due to rounding.

* Employers in application group Abrasive Blasting – Shipyards are shipyards employing abrasive blasters that use mineral slag abrasives to etch the surfaces of boats and ships.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Appendix IV-B

Summary of Annualized Cost Savings by Cost Type under Alternative Discount Rates

In addition to using a 3 percent discount rate in its cost analysis, OSHA estimated compliance cost savings using alternative discount rates of 7 percent and 0 percent. Tables IV-21 and IV-22 present— for 7 percent and 0 percent discount rates, respectively—total annualized cost savings for affected employers by NAICS industry code and type of cost savings.

Table IV-21: Annualized Compliance Cost Savings for Employers Affected by the Beryllium Standard by Sector and Six-Digit NAICS Industry (7 Percent Discount Rate, in 2019 Dollars)

Application Group/ NAICS	Industry	Engineering Controls and Work Practices	Respirator Cost Savings	Program Cost Savings	Total Cost Savings
Abrasive Blasting – Construction					
238320	Painting and Wall Covering Contractors	\$0	\$21,257	\$946,635	\$967,892
238990	All Other Specialty Trade Contractors	\$0	\$19,697	\$877,157	\$896,854
Abrasive Blasting – Shipyards					
336611a	Ship Building and Repairing	\$0	\$14,438	\$663,909	\$678,347
Welding – Shipyards					
336611b	Ship Building and Repairing	\$0	\$887	\$20,521	\$21,408
Total					
Construction Subtotal		\$0	\$40,954	\$1,823,792	\$1,864,746
Maritime Subtotal		\$0	\$15,325	\$684,430	\$699,755
Total, All Industries		\$0	\$56,279	\$2,508,222	\$2,564,501

Note: Figures in rows may not add to totals due to rounding.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

Table IV-22: Annualized Compliance Cost Savings for Employers Affected by the Beryllium Standard by Sector and Six-Digit NAICS Industry (0 Percent Discount Rate, in 2019 Dollars)

Application Group/ NAICS	Industry	Engineering Controls and Work Practices	Respirator Cost Savings	Program Cost Savings	Total Cost Savings
Abrasive Blasting – Construction					
238320	Painting and Wall Covering Contractors	\$0	\$20,684	\$926,069	\$946,753
238990	All Other Specialty Trade Contractors	\$0	\$19,166	\$858,100	\$877,267
Abrasive Blasting – Shipyards					
336611a	Ship Building and Repairing	\$0	\$14,067	\$649,592	\$663,659
Welding – Shipyards					
336611b	Ship Building and Repairing	\$0	\$868	\$19,979	\$20,848
Total					
Construction Subtotal		\$0	\$39,850	\$1,784,169	\$1,824,020
Maritime Subtotal		\$0	\$14,935	\$669,571	\$684,507
Total, All Industries		\$0	\$54,786	\$2,453,741	\$2,508,526

Note: Figures in rows may not add to totals due to rounding.

Source: US DOL, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis (OSHA, 2020) (Document ID 2250).

E. Benefits

The changes in this rule are designed to accomplish three goals: (1) to more appropriately tailor the requirements of the construction and shipyards standards to the particular exposures in these industries in light of partial overlap between the beryllium standards' requirements and other OSHA standards; (2) to more closely align the construction and shipyards standards to the general industry standard, with respect to the updates to the medical definitions and medical surveillance, where appropriate; and (3) to clarify certain requirements with respect to materials containing only trace amounts of beryllium. As to the first group of changes, this rule clarifies that OSHA did not, and does not, intend the provisions aimed at protecting workers from the effects of dermal contact to apply in the case of materials containing only trace amounts of beryllium in the absence of significant airborne exposures. In the prior FEA, OSHA did not

isolate any quantifiable benefits from avoiding beryllium sensitization from dermal contact (see discussion at p. VII-16 through VII-18). Therefore, OSHA concludes that the revisions in this rule that focus on dermal contact will not have any impact on OSHA's previous benefit estimates for the standards as a whole.

OSHA also does not expect the second and third groups of changes, i.e., those intended to more closely tailor the standards' requirements to the construction and shipyard industries and closely align them to the general industry standard's requirements, where appropriate, to result in a reduction in benefits. Rather, as explained in the summary and explanation, OSHA believes that the changes would maintain safety and health protections for workers while aligning the standards with the intent behind the 2017 final rule and otherwise preventing costs that could follow from misinterpretation or misapplication of the standards. Therefore, OSHA determines that the effect of these revisions on the benefits of the standards as a whole would be negligible.

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V. Economic Feasibility Analysis and Regulatory Flexibility Certification

Economic Feasibility Analysis

In the 2017 FEA, OSHA concluded that the beryllium standards for construction and shipyards were both economically feasible (see 82 FR at 2471). OSHA is modifying some of the

ancillary provisions in both standards and has concluded that the revisions would, overall, reduce costs for employers in both sectors (see section D, Costs of Compliance, in this FEA). Because the effect of this rule is a net reduction in costs, OSHA has determined that this rule is economically feasible in both the construction and shipyard sectors.

Regulatory Flexibility Certification

In accordance with the Regulatory Flexibility Act, 5 U.S.C. 601 et seq. (as amended), OSHA has examined the regulatory requirements of the rule for construction and shipyards to determine whether they would have a significant economic impact on a substantial number of small entities. This rule would modify certain ancillary provisions for shipyards and construction, resulting in a reduction of overall costs. Furthermore, the agency believes that this rule would not impose any additional costs on small entities. Accordingly, OSHA certifies that the rule would not have a significant economic impact on a substantial number of small entities.

VI. OMB Review Under the Paperwork Reduction Act of 1995

A. Overview

OSHA is updating the beryllium standards for the construction and shipyards industries, which contain collections of information that are subject to review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (PRA), 44 U.S.C. 3501 et seq., and OMB regulations at 5 CFR part 1320. The beryllium standards for general industry (29 CFR 1910.1024), construction (29 CFR 1926.1124), and shipyards (29 CFR 1915.1024) contain collection of information (paperwork) requirements that have been previously approved by OMB under OMB control number 1218-0267. In this rulemaking, OSHA is separating the collections of information in the beryllium standards for construction and shipyards from those in the general industry standard. Therefore, the agency is submitting two new information collection

requests (ICRs)—one for the construction industry and one for the shipyards sector. In addition, OSHA is removing the collections of information related to construction and shipyards from the collections of information currently approved by OMB under control number 1218-0267. This will be a separate action and will occur after OMB approval of the new ICRs.

The PRA defines “collection of information” to mean the obtaining, causing to be obtained, soliciting, or requiring the disclosure to third parties or the public, of facts or opinions by or for an agency, regardless of form or format (44 U.S.C. 3502(3)(A)). Under the PRA, a Federal agency cannot conduct or sponsor a collection of information unless OMB approves it, and the agency displays a currently valid OMB control number (44 U.S.C. 3507). Also, notwithstanding any other provision of law, no employer shall be subject to penalty for failing to comply with a collection of information if the collection of information does not display a currently valid OMB control number (44 U.S.C. 3512).

On January 9, 2017, OSHA published a final rule for the general industry, construction, and shipyard sectors that established new permissible exposure limits and other provisions to protect employees from beryllium exposure, such as requirements for exposure assessment, respiratory protection, personal protective clothing and equipment, housekeeping, medical surveillance, hazard communication, and recordkeeping. OMB approved the collections of information contained in the final rule under OMB Control Number 1218-0267.

On October 8, 2019, OSHA published a proposed rule to modify the construction and shipyard standards by clarifying certain provisions to improve and simplify compliance (84 FR 53902). The 2019 proposal would revise the collections of information contained in the construction and shipyard standard approved by OMB by clarifying requirements related to the written exposure control plan; the cleaning and replacement of personal protection equipment;

the disposal, recycling, and reuse of contaminated materials; the frequency of medical examinations for employees who have been exposed to beryllium during an emergency or who show signs and symptoms of CBD; referrals to the CBD diagnostic center; and the collection and recording of social security numbers in medical surveillance and recordkeeping. OSHA prepared and submitted two new ICRs to OMB under the 2019 proposed rule for review in accordance with 44 U.S.C. 3507(d). OSHA proposed to separate the construction and shipyard sectors from the 2017 Beryllium ICR approved by OMB under OMB Control Number 1218-0267. The three beryllium standards would have separate OMB control numbers for each industry.

B. Solicitation of Comments

In accordance with the PRA (44 U.S.C. 3506(c)(2)), the agency solicited public comments on the collection of information contained in the 2019 proposed rule. OSHA encouraged commenters to submit their comments on the information collection requirements contained in the proposed rule under docket number OSHA-2019-0006, along with their comments on other parts of the proposed rule. In addition to generally soliciting comments on the collection of information requirements, the proposed rule indicated that OSHA and OMB were particularly interested in comments on the following items:

- Whether the proposed collections of information are necessary for the proper performance of the functions of the agency, including whether the information will have practical utility;
- The accuracy of OSHA's estimate of the burden (time and cost) of the proposed collections of information, including the validity of the methodology and assumptions used;
- The quality, utility, and clarity of the information to be collected; and

- Ways to minimize the compliance burden on employers, for example, by using automated or other technological techniques for collecting and transmitting information (78 FR at 56438).

On November 8, 2019, OMB issued a Notice of Action (NOA) assigning the information collection requests new OMB control numbers and stating, “This OMB action is not an approval to conduct or sponsor an information collection under the Paperwork Reduction Act of 1995. This action has no effect on any current approvals. If OMB has assigned this ICR a new OMB Control Number, the OMB Control Number will not appear in the active inventory. For future submissions of this information collection, reference the OMB Control Number provided. OMB is withholding approval at this time. Prior to publication of the final rule, the agency should provide a summary of any comments related to the information collection and their response, including any changes made to the ICR as a result of comments. In addition, the agency must enter the correct burden estimates.” At this time, the ICR for the beryllium standard for construction was assigned OMB Control Number 1218-0273 and the beryllium standard for shipyards was assigned OMB Control Number 1218-0272. Copies of the proposed ICRs are available to the public at

<http://www.reginfo.gov/public/do/PRAOMBHistory?ombControlNumber=1218-0273> and

<http://www.reginfo.gov/public/do/PRAOMBHistory?ombControlNumber=1218-0272>.

OSHA did not receive any public comments in response to the proposed ICRs.⁵⁹

However, the agency received 16 public comments on the proposed rule during the initial comment period. In addition, OSHA held a public hearing on the proposal on December 3, 2019,

⁵⁹ Two commenters submitted comments to docket number OSHA-2019-0006 (see Document ID OSHA-2019-0006-0003; OSHA-2019-0006-0004). The comments did not concern the paperwork requirements but rather addressed other portions of the proposal. Neither comment was submitted during the comment period for the proposed rule, which ended on November 7, 2019.

where the agency heard testimony from several stakeholders (see Document ID 2222; 2223). Participants who filed notices of intention to appear at the hearing were permitted to submit additional evidence and data relevant to the proceedings for a period of 44-days following the hearing. That post-hearing comment period closed on January 16, 2020. The record remained open for an additional 15 days, until January 31, 2020, for the submission of final briefs, arguments, and summations. OSHA received twenty five timely comments during this rulemaking by the close of the last post-hearing comment period of January 31, 2020. The comments submitted in response to the proposed rule and the hearing proceedings did modify some provisions containing collections of information. These responses were considered when OSHA prepared these two new ICRs for the final rule.

C. Information Collection Requirements

As required by 5 CFR 1320.5(a)(1)(iv) and 1320.8(d)(2), the following paragraphs provide information about these two ICRs.

Construction (ICR):

1. *Title:* Occupational Exposure to Beryllium for the Construction Industry (29 CFR 1926.1124).
2. *Description of the ICR:* The final rule separates the information collection requirements of the construction standard from the currently approved beryllium ICR. This action creates a new ICR containing only the collection of information requirements for the construction industry.
3. *Brief Summary of the Information Collection Requirements:*

The final rule revises the collection of information requirements contained in the existing ICR for the construction industry, approved under OMB under control number 1218-0267.

OSHA, first, has separated the construction collection of information requirements from those of the general industry and shipyards standards and created a new ICR containing only those collection of information requirements in the construction industry. As a result, OMB has assigned a new OMB control number specific to the construction standard (1218-0273). Next, OSHA has updated the new ICR to reflect revisions made by this final rule, which (1) remove provisions in the construction standard that require employers to collect and record employees' social security number; (2) revise the contents of the written exposure control plan; and (3) remove certain requirements related to written warnings. See Table VI.1.

Table VI.1 -- Collection of Information Requirements Being Revised in the Beryllium Standard for Construction

Section number and title	Currently approved collection of information requirements	Action Taken
§1926.1124(f)(1)(i) -- Methods of Compliance -- Written Exposure Control Plan.	<ul style="list-style-type: none"> • A list of operations and job titles reasonably expected to involve airborne exposure to or dermal contact with beryllium; • A list of operations and job titles reasonably expected to involve airborne exposure at or above the action level; • A list of operations and job titles reasonably expected to involve airborne exposure above the TWA PEL or STEL; 	Revised paragraph (f)(1)(i)(A) to list operations and job titles and removed “airborne” and “or dermal contact” from the text. Removed paragraphs (f)(1)(i)(B) through (E), written exposure control plan.

Section number and title	Currently approved collection of information requirements	Action Taken
	<ul style="list-style-type: none"> • Procedures for minimizing cross-contamination; • Procedures for minimizing the migration of beryllium within or to locations outside the workplace; • A list of engineering controls, work practices, and respiratory protection required by §1926.1124(f)(2); • A list of personal protective clothing and equipment required by §1926.1124(h); • Procedures for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated personal protective clothing and equipment, including respirators; • Procedures used to restrict access to work areas when airborne exposures are, or can reasonably be expected to be, above the TWA PEL or STEL, to minimize the number of employees exposed to airborne beryllium and their level of exposure, 	<p>Added a new requirement, paragraph (f)(1)(i)(E), to list procedures used to ensure the integrity of each containment used to minimize exposures to employees outside the containment.</p> <p>Revised paragraph (f)(1)(i)(H) to require a list of procedures for removing, cleaning, and maintaining personal protective clothing and equipment in accordance with paragraph (h) and renumbered as paragraph (f)(1)(i)(F).</p>

Section number and title	Currently approved collection of information requirements	Action Taken
	including exposures generated by other employers or sole proprietors.	
§1926.1124(f)(1)(ii)(B) -- Methods of Compliance -- Written Exposure Control Plan.	The employer is notified that an employee is eligible for medical removal in accordance with §1926.1124(l)(1), referred for evaluation at a chronic beryllium disease (CBD) diagnostic center, or shows signs or symptoms associated with airborne exposure to or dermal contact with beryllium	Removed “airborne” and “or dermal contact with” from paragraph (f)(1)(ii)(B).
§1926.1124(h)(2)(v) -- Personal Protective Clothing and Equipment -- Removal and Storage.	When personal protective clothing or equipment required by this standard is removed from the workplace for laundering, cleaning, maintenance or disposal, the employer must ensure that personal protective clothing and equipment are stored and transported in sealed bags or other closed containers that are impermeable and are labeled in accordance with §1926.1124(m)(3) and the HCS (29 CFR 1910.1200).	Removed this labeling requirement from the beryllium standard for construction and therefore from the ICR.

Section number and title	Currently approved collection of information requirements	Action Taken
§1926.1124(h)(3)(iii) -- Personal Protective Clothing and Equipment -- Cleaning and Replacement.	The employer must inform in writing the persons or the business entities who launder, clean or repair the personal protective clothing or equipment required by this standard of the potentially harmful effects of airborne exposure to and dermal contact with beryllium and that the personal protective clothing and equipment must be handled in accordance with the standard.	Removed this requirement from the beryllium standard for construction and therefore from the ICR.
§1926.1124(j)(3) – Housekeeping-- Disposal.	When the employer transfers materials containing beryllium to another party for use or disposal, the employer must provide the recipient with a copy of the warning described in §1926.1124(m)(2).	Removed this requirement from the beryllium standard for construction and therefore from the ICR.
§1926.1124(k)(1)(i)(C) –Medical Surveillance.	Who is exposed to beryllium during an emergency	Removed paragraph (k)(1)(i)(C) from the beryllium standard for construction and therefore from the ICR. Renumbered

Section number and title	Currently approved collection of information requirements	Action Taken
		former paragraph (k)(1)(i)(D) as (k)(1)(i)(C).
§1926.1124(k)(2)(i)(B) –Medical Surveillance.	An employee meets the criteria of §1926.1124(k)(1)(i)(B) or (C).	Removed “or (C)” from paragraph (k)(2)(i)(B) from the beryllium standard for construction and therefore from the ICR.
§1926.1124(k)(2)(ii) – Medical Surveillance.	At least every two years thereafter for each employee who continues to meet the criteria of §1926.1124(k)(1)(i)(A), (B), or (D).	Replaced “(D)” with “(C)” in paragraph
§1926.1124(k)(3)(ii)(A) –Medical Surveillance.	A medical and work history, with emphasis on past and present airborne exposure to or dermal contact with beryllium, smoking history, and any history of respiratory system dysfunction	Revised paragraph (k)(3)(ii)(A) to remove “airborne” and “or dermal contact” from the text.
§1926.1124(k)(4)(i) -- Information Provided to the PLHCP.	A description of the employee's former and current duties that relate to the employee's	Revised paragraph (k)(4)(i) to remove “airborne” and

Section number and title	Currently approved collection of information requirements	Action Taken
	airborne exposure and dermal contact with beryllium	“and dermal contact with” from the text.
§1926.1124(k)(7) -- Medical Surveillance-- Referral to the CBD Diagnostic Center.	The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The examination must be provided within 30 days of either of the events in §1926.1124(k)(7)(i)(A) or (B).	Revised the initial consultation with the CBD diagnostic center, as follows: The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The evaluation at the CBD diagnostic center must be scheduled within 30 days, and must occur within a reasonable time, of:

Section number and title	Currently approved collection of information requirements	Action Taken
		<p>Added a new requirement in paragraph (k)(7)(ii) that the evaluation must include any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. If any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may be performed at another location that is mutually agreed upon by the</p>

Section number and title	Currently approved collection of information requirements	Action Taken
		<p>employer and the employee.</p> <p>As result of the changes, OSHA renumbered the subordinate paragraphs in (k)(7).</p>
<p>§ 1926.1124(m)(2) – Warning labels</p>	<p>Consistent with the HCS (29 CFR 1910.1200), the employer must label each bag and container of clothing, equipment, and materials contaminated with beryllium, and must, at a minimum, include the following on the label:</p> <p>DANGER</p> <p>CONTAINS BERYLLIUM</p> <p>MAY CAUSE CANCER</p> <p>CAUSES DAMAGE TO LUNGS</p> <p>AVOID CREATING DUST</p> <p>DO NOT GET ON SKIN</p>	<p>Removed this requirement from the beryllium standard for construction and therefore from the ICR.</p>

Section number and title	Currently approved collection of information requirements	Action Taken
§ 1926.1124(m)(3)(i) – Employee information and training	For each employee who has, or can reasonably be expected to have, airborne exposure to or dermal contact with beryllium	Removed “airborne” and “and dermal contact with” from paragraph (m)(3)(i).
§1926.1124(n)(1)(ii)(F) -- Recordkeeping --Air Monitoring Data.	The name, social security number, and job classification of each employee represented by the monitoring, indicating which employees were actually monitored.	<p>Removed the requirement to collect and record social security numbers, as follows:</p> <p>The name and job classification of each employee represented by the monitoring, indicating which employees were actually monitored.</p>
§1926.1124(n)(3)(ii)(A)- - Recordkeeping-- Medical Surveillance.	The record must include the following information about the employee: Name, social security number, and job classification.	Removed the requirement to collect and record social security numbers, as follows:

Section number and title	Currently approved collection of information requirements	Action Taken
		The record must include the following information about the employee: Name and job classification.
§1926.1124(n)(4)(i) -- Recordkeeping -- Training.	At the completion of any training required by the standard, the employer must prepare a record that indicates the name, social security number, and job classification of each employee trained, the date the training was completed, and the topic of the training.	Removed the requirement to collect and record social security numbers, as follows: At the completion of any training required by the standard, the employer must prepare a record that indicates the name and job classification of each employee trained, the date the training was completed, and the topic of the training.

4. *OMB Control Number:* 1218-0273
5. *Affected Public:* Business or other-for-profit. This standard applies to employers in the construction industry who have employees that may have occupational exposures to any form of beryllium, including compounds and mixtures, except those articles and materials exempted by paragraphs (a)(2) and (3) of the standard.
6. *Number of Respondents:* 2,100
7. *Frequency of Responses:* On occasion, quarterly, semi-annually, annual, biannual.
8. *Number of Responses:* 29,330
9. *Average Time per Response:* Varies.
10. *Estimated Annual Total Burden Hours:* 18,075
11. *Estimated Annual Total Cost (Capital-operation and maintenance):* \$5,611,902

Shipyards (ICR):

1. *Title:* Occupational Exposure to Beryllium for the Shipyards Sector (29 CFR 1915.1024).
2. *Description of the ICR:* The final rule separates information collection requirements of the shipyards standard from the currently approved beryllium ICR. This action creates a new ICR containing only the collection of information requirements for the shipyard sector.
3. *Brief Summary of the Information Collection Requirements:*

This final rule revises the collection of information requirements contained in the existing ICR for the shipyards industry, approved under OMB under control number 1218-0267. OSHA, first, has separated the shipyards collection of information requirements from those of the general industry and construction standards and created a new ICR containing only those collection of information requirements in the shipyard sectors. As a result, OMB has assigned a new OMB control number specific to the shipyards standard (1218-0272). Next, OSHA has updated the

new ICR to reflect revisions made by this final rule, which (1) remove provisions in the shipyards standard that require employers to collect and record employees' social security number; (2) revise the contents of the written exposure control plan; and (3) remove certain requirements related to written warnings. See Table VI.2.

Table VI.2 -- Collection of Information Requirements Being Revised in the Beryllium Standard for Shipyards

Section number and title	Currently approved collection of information requirements	Action Taken
§1915.1024(f)(1)(i) -- Methods of Compliance -- Written Exposure Control Plan.	<p>The employer must establish, implement, and maintain a written exposure control plan, which must contain:</p> <ul style="list-style-type: none"> • A list of operations and job titles reasonably expected to involve exposure to or dermal contact with beryllium; • A list of operations and job titles reasonably expected to involve airborne exposure at or above the AL; • A list of operations and job titles reasonably expected to involve airborne exposure above the TWA PEL or STEL; • Procedures for minimizing cross-contamination; 	<p>Revised paragraph (f)(1)(i)(A) to list operations and job titles reasonably expected to involve exposure to beryllium.</p> <p>Removed paragraphs (f)(1)(i)(B) through (E) the written exposure control plan.</p> <p>Added a new requirement, paragraph (f)(1)(i)(D) to list procedures used to ensure</p>

Section number and title	Currently approved collection of information requirements	Action Taken
	<ul style="list-style-type: none"> • Procedures for minimizing the migration of beryllium within or to locations outside the workplace; • A list of engineering controls, work practices, and respiratory protection required by §1915.1024(f)(2); • A list of personal protective clothing and equipment required by §1915.1024(h); and • Procedures for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated personal protective clothing and equipment, including respirators. 	<p>the integrity of each containment used to minimize exposures to employees outside the containment.</p> <p>Revised paragraph (f)(1)(i)(H) to require a list procedures for removing, cleaning, and maintaining personal protective clothing and equipment in accordance with paragraph (h) and renumbered as paragraph (f)(1)(i)(E).</p>
<p>§1915.1024(f)(1)(ii)(B) -- Methods of Compliance -- Written Exposure Control Plan.</p>	<p>The employer is notified that an employee is eligible for medical removal in accordance with §1915.1024(l)(1), referred for evaluation at a chronic beryllium disease (CBD) diagnostic center, or shows signs or symptoms associated with airborne</p>	<p>Removed “airborne” and “or dermal contact with” from paragraph (f)(1)(ii)(B).</p>

Section number and title	Currently approved collection of information requirements	Action Taken
	exposure to or dermal contact with beryllium	
§1915.1024(h)(2)(v) -- Personal Protective Clothing and Equipment -- Removal and Storage.	When personal protective clothing or equipment required by this standard is removed from the workplace for laundering, cleaning, maintenance or disposal, the employer must ensure that personal protective clothing and equipment are stored and transported in sealed bags or other closed containers that are impermeable and are labeled in accordance with §1915.1024(m)(3) and the HCS (29 CFR 1910.1200).	Removed this labeling requirement from the beryllium standard for shipyards and therefore from the ICR.
§1915.1024(h)(3)(iii) -- Personal Protective Clothing and Equipment -- Cleaning and Replacement.	The employer must inform in writing the persons or the business entities who launder, clean or repair the personal protective clothing or equipment required by this standard of the potentially harmful effects of airborne exposure to and dermal contact	Removed this requirement from the beryllium standard for shipyards and therefore from the ICR.

Section number and title	Currently approved collection of information requirements	Action Taken
	with beryllium and that the personal protective clothing and equipment must be handled in accordance with the standard.	
§1915.1024(j)(3) – Housekeeping-- Disposal.	When the employer transfers materials containing beryllium to another party for use or disposal, the employer must provide the recipient with a copy of the warning described in §1915.1024(m)(2).	Removed this requirement from the beryllium standard for shipyards and therefore from the ICR.
§1915.1024(k)(1)(i)(C) –Medical Surveillance.	Who is exposed to beryllium during an emergency	Removed paragraph (k)(1)(i)(C) from the beryllium standard for construction and therefore from the ICR. Renumbered former paragraph (k)(1)(i)(D) as (k)(1)(i)(C).
§1915.1124(k)(2)(i)(B) –Medical Surveillance.	An employee meets the criteria of §1915.1024(k)(1)(i)(B) or (C).	Removed “or (C) of this standard” from paragraph (k)(2)(i)(B) from the beryllium standard for

Section number and title	Currently approved collection of information requirements	Action Taken
		construction and therefore from the ICR.
§1915.1124(k)(2)(ii) – Medical Surveillance.	At least every two years thereafter for each employee who continues to meet the criteria of §1915.1024(k)(1)(i)(A), (B), or (D).	Replaced “(D)” with “(C)” in paragraph (k)(2)(ii).
§1915.1124(k)(3)(ii)(A) –Medical Surveillance.	A medical and work history, with emphasis on past and present airborne exposure to or dermal contact with beryllium, smoking history, and any history of respiratory system dysfunction	Revised paragraph (k)(3)(ii)(A) to remove “airborne” and “or dermal contact with” from the text.
§1915.1124(k)(4)(i) -- Information Provided to the PLHCP.	A description of the employee's former and current duties that relate to the employee's airborne exposure and dermal contact with beryllium	Revised paragraph (k)(4)(i) to remove “airborne” and “and dermal contact with” from the text.
§1915.1024(k)(7) -- Medical Surveillance-- Referral to the CBD Diagnostic Center.	The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The	Revised an initial consultation with the CBD diagnostic center.

Section number and title	Currently approved collection of information requirements	Action Taken
	<p>examination must be provided within 30 days of either of the events in §1915.1024(k)(7)(i)(A) or (B).</p>	<p>The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The evaluation at the CBD diagnostic center must be scheduled within 30 days, and must occur within a reasonable time, of:</p> <p>Added a new requirement in paragraph (k)(7)(ii) that the evaluation must include any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function</p>

Section number and title	Currently approved collection of information requirements	Action Taken
		<p>testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. If any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may be performed at another location that is mutually agreed upon by the employer and the employee.</p> <p>As result of the changes, OSHA renumbered the subordinate paragraphs in (k)(7).</p>

Section number and title	Currently approved collection of information requirements	Action Taken
<p>§ 1915.1024(m)(2) – Warning labels</p>	<p>Consistent with the HCS (29 CFR 1910.1200), the employer must label each bag and container of clothing, equipment, and materials contaminated with beryllium, and must, at a minimum, include the following on the label:</p> <p>DANGER</p> <p>CONTAINS BERYLLIUM</p> <p>MAY CAUSE CANCER</p> <p>CAUSES DAMAGE TO LUNGS</p> <p>AVOID CREATING DUST</p> <p>DO NOT GET ON SKIN</p>	<p>Removed this requirement from the beryllium standard for construction and therefore from the ICR.</p>
<p>§ 1926.1124(m)(3)(i) – Employee information and training</p>	<p>For each employee who has, or can reasonably be expected to have, airborne exposure to or dermal contact with beryllium</p>	<p>Removed “airborne” and “and dermal contact with” from paragraph (m)(3)(i).</p>
<p>§1915.1024(n)(1)(ii)(F) -- Recordkeeping --Air Monitoring Data.</p>	<p>The name, social security number, and job classification of each employee represented</p>	<p>Removed the requirement to collect and record social</p>

Section number and title	Currently approved collection of information requirements	Action Taken
	by the monitoring, indicating which employees were actually monitored.	<p>security numbers, as follows:</p> <p>The name and job classification of each employee represented by the monitoring, indicating which employees were actually monitored.</p>
<p>§1915.1024(n)(3)(ii)(B)</p> <p>-- Recordkeeping--</p> <p>Medical Surveillance.</p>	<p>The record must include the following information about the employee: Name, social security number, and job classification.</p>	<p>Remove the requirement to collect and record of social security numbers, as follows: Name and job classification.</p>
<p>§1915.1024(n)(4)(i) --</p> <p>Recordkeeping --</p> <p>Training.</p>	<p>At the completion of any training required by this standard, the employer must prepare a record that indicates the name, social security number, and job classification of each employee trained, the date the training was completed, and the topic of the training.</p>	<p>Remove the requirement to collect and record social security numbers, as follows:</p>

Section number and title	Currently approved collection of information requirements	Action Taken
		At the completion of any training required by this standard, the employer must prepare a record that indicates the name and job classification of each employee trained, the date the training was completed, and the topic of the training.

4. *OMB Control Number:* 1218-0272

5. *Affected Public:* Business or other-for-profit. This standard applies to employers in the shipyards industry who have employees that may have occupational exposures to any form of beryllium, including compounds and mixtures, except those articles and materials exempted by paragraphs (a)(2) and (3) of the standard

6. *Number of Respondents:* 696

7. *Frequency of Responses:* On occasion, quarterly, semi-annually, annual, biannual.

8. *Number of Responses:* 10,794

9. *Average Time per Response:* Varies.

10. *Estimated Annual Total Burden Hours:* 6,609

11. *Estimated Annual Total Cost (Capital-operation and maintenance): \$2,057,856*

VII. Federalism

OSHA reviewed this final rule in accordance with the Executive order on Federalism (E.O. 13132, 64 FR 43255, August 10, 1999), which requires that Federal agencies, to the extent possible, refrain from limiting State policy options, consult with States prior to taking any actions that would restrict State policy options, and take such actions only when clear constitutional and statutory authority exists and the problem is national in scope. E.O. 13132 provides for preemption of State law only with the expressed consent of Congress. Any such preemption is to be limited to the extent possible.

Under Section 18 of the OSH Act, Congress expressly provides that States and U.S. territories may adopt, with Federal approval, a plan for the development and enforcement of occupational safety and health standards. OSHA refers to such States and territories as “State Plans” (29 U.S.C. 667). Occupational safety and health standards developed by State Plans must be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. Subject to these requirements, State Plans are free to develop and enforce under State law their own requirements for safety and health standards.

OSHA previously concluded that promulgation of the beryllium standard complies with E.O. 13132 (82 FR at 2633), so this final rule complies with E.O. 13132. In States without OSHA-approved State Plans, Congress expressly provides for OSHA standards to preempt State occupational safety and health standards in areas addressed by the Federal standards. In these States, this final rule limits State policy options in the same manner as every standard promulgated by OSHA. In States with OSHA-approved State Plans, this rulemaking does not significantly limit State policy options.

VIII. State Plans

When federal OSHA promulgates a new standard or more stringent amendment to an existing standard, the states and U.S. Territories with their own OSHA-approved occupational safety and health plans (State Plans) must promulgate a state standard adopting such new Federal standard, or more stringent amendment to an existing Federal standard, or an at least as effective equivalent thereof, within six months of promulgation of the new Federal standard or more stringent amendment. The state may demonstrate that a standard change is not necessary because the state standard is already the same or at least as effective as the Federal standard change. Because a state may include standards and standard provisions that are equally or more stringent than Federal standards, it would generally be unnecessary for a state to revoke a standard when the comparable Federal standard is revoked or made less stringent. To avoid delays in worker protection, the effective date of the state standard and any of its delayed provisions must be the date of state promulgation or the Federal effective date, whichever is later. The Assistant Secretary may permit a longer time period if the state makes a timely demonstration that good cause exists for extending the time limitation (29 CFR 1953.5(a)).

Of the 28 states and territories with OSHA-approved State Plans, 22 cover public and private-sector employees: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, and Wyoming. The remaining six states and territories cover only state and local government employees: Connecticut, Illinois, Maine, New Jersey, New York, and the Virgin Islands.

As discussed in detail in Section III, Summary and Explanation of the Final Rule, while many of the revised provisions in this final rule provide equivalent protection to the provisions of

the 2017 standards, changes made by this final rule will clarify certain provisions and simplify or improve employer compliance, for example, by clarifying the medical definitions and medical surveillance provisions and aligning them with the general industry standard. In the July 2020 general industry final rule adopting many of the same clarifying revisions, OSHA determined, in part based on comments received, that these revisions enhance employee safety by ensuring provisions are not misinterpreted (85 FR 42595). Accordingly, OSHA determined that it was appropriate to require states to adopt the changes made by that final rule.

OSHA received no comments with respect to State Plans in this rulemaking. After considering all of the changes made by this final rule and the record as a whole, OSHA believes that this final rule also enhances employee safety, in part, by revising confusing provisions. Therefore, OSHA has determined that, within six months of the rule's promulgation date, State Plans must review their state standards and adopt amendments to those standards that are at least as effective as the amendments to the beryllium construction and shipyard standard finalized herein, as required by 29 CFR 1953.5(a), unless a State Plan demonstrates that such amendments are not necessary because their existing standards are already at least as effective at protecting workers as this final rule.

IX. Unfunded Mandates Reform Act

OSHA reviewed this final rule according to the Unfunded Mandates Reform Act of 1995 ("UMRA"; 2 U.S.C. 1501 et seq.) and Executive Order 13132 (64 FR 43255 (August 4, 1999)). As discussed above in Section IV ("Final Economic Analysis") of this preamble, the agency has determined that this final rule would not impose significant additional costs on any private- or public-sector entity. Further, OSHA previously concluded that the rule would not impose a federal mandate on the private sector in excess of \$100 million (adjusted annually for inflation)

in expenditures in any one year (82 FR at 2634). Accordingly, this final rule will not require significant additional expenditures by either public or private employers.

As noted above under Section VIII, (“State-Plans”), the agency’s standards do not apply to State and local governments except in states that have elected voluntarily to adopt a State Plan approved by the agency. Consequently, this final rule does not meet the definition of a “Federal intergovernmental mandate” (see Section 421(5) of the UMRA (2 U.S.C. 658(5))). Therefore, for the purposes of the UMRA, the agency certifies that this final rule does not mandate that state, local, or tribal governments adopt new, unfunded regulatory obligations of, or increase expenditures by the private sector by, more than \$100 million in any year.

X. Environmental Impacts

OSHA has reviewed this final rule according to the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), the regulations of the Council on Environmental Quality (40 CFR part 1500), and the Department of Labor’s NEPA procedures (29 CFR part 11). OSHA has determined that this final rule will have no significant impact on air, water, or soil quality; plant or animal life; the use of land; or aspects of the external environment.

XI. Consultation and Coordination with Indian Tribal Governments

OSHA reviewed this final rule in accordance with E.O. 13175 (65 FR 67249) and determined that it does not have “tribal implications” as defined in that order. This final rule does not have substantial direct effects on one or more Indian tribes, on the relationship between the Federal Government and Indian tribes, or on the distribution of power and responsibilities between the Federal Government and Indian tribes.

List of Subjects in 29 CFR Parts 1915 and 1926

Beryllium, Cancer, Chemicals, Hazardous substances, Health, Occupational safety and health.

Authority and Signature

This document was prepared under the direction of Loren Sweatt, Principal Deputy Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, Washington, DC 20210.

The agency issues the sections under the following authorities: 29 U.S.C. 653, 655, 657; 40 U.S.C. 3704; 33 U.S.C. 941; Secretary of Labor's Order 1-2012 (77 FR 3912 (January 25, 2012)); and 29 CFR part 1911.

Signed at Washington, DC, on August 13, 2020.

Loren Sweatt,

Principal Deputy Assistant Secretary of Labor for Occupational Safety and Health.

Amendments to Standards

For the reasons set forth in the preamble, chapter XVII of title 29, parts 1915 and 1926, of the Code of Federal Regulations is amended as follows:

PART 1915—OCCUPATIONAL SAFETY AND HEALTH STANDARDS FOR SHIPYARD EMPLOYMENT

1. The authority citation for part 1915 continues to read as follows:

Authority: 33 U.S.C. 941; 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 12-71 (36 FR 8754); 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), 6-96 (62 FR 111), 3-2000 (65 FR 50017), 5-2002 (67 FR 65008), 5-2007 (72 FR 31160), 4-2010 (75 FR 55355), or 1-2012 (77 FR 3912); 29 CFR part 1911; and 5 U.S.C. 553, as applicable.

2. Amend § 1915.1024 by:

a. In paragraph (b), add a definition for “Beryllium sensitization” in alphabetical order, revise the definitions for “CBD diagnostic center,” “Chronic beryllium disease (CBD),” and “Confirmed

positive,” and remove the definitions of “Emergency” and “High-efficiency particulate air (HEPA) filter.”

- b. Revise paragraph (f)(1)(i)(A).
- c. Remove paragraphs (f)(1)(i)(B), (C), (D), (E), and (H).
- d. Redesignate paragraphs (f)(1)(i)(F) and (G) as paragraphs (f)(1)(i)(B) and (C).
- e. In newly redesignated paragraph (f)(1)(i)(C), remove the word “and” at the end of the paragraph;
- f. Add new paragraphs (f)(1)(i)(D) and (E).
- g. Revise paragraphs (f)(1)(ii)(B), (f)(2), and (g)(1)(iii).
- h. Remove paragraph (g)(1)(iv).
- i. Redesignate paragraph (g)(1)(v) as paragraph (g)(1)(iv).
- j. Revise paragraphs (h)(1) and (2) and (h)(3)(ii).
- k. Remove paragraph (h)(3)(iii).
- l. Remove and reserve paragraph (i).
- m. Revise paragraphs (j) and (k)(1)(i)(B).
- n. Remove paragraph (k)(1)(i)(C).
- o. Redesignate paragraph (k)(1)(i)(D) as paragraph (k)(1)(i)(C).
- p. Revise paragraphs (k)(2)(i)(B), (k)(2)(ii), (k)(3)(ii)(A), (k)(4)(i), and (k)(7)(i) introductory text.
- q. Redesignate paragraphs (k)(7)(ii) through (v) as paragraphs (k)(7)(iii) through (vi).
- r. Add a new paragraph (k)(7)(ii).
- s. Revise paragraph (m)(1)(ii).
- t. Remove paragraph (m)(3).

- u. Redesignate paragraph (m)(4) as paragraph (m)(3).
- v. Revise newly redesignated paragraphs (m)(3)(i) introductory text and (m)(3)(ii)(A).
- w. Remove newly redesignated paragraph (m)(3)(ii)(D).
- x. Further redesignate newly redesignated paragraphs (m)(3)(ii)(E) through (I) as paragraphs (m)(3)(ii)(D) through (H).
- z. Revise newly redesignated paragraphs (m)(3)(ii)(D) and (m)(3)(iv) and paragraphs (n)(1)(ii)(F), (n)(3)(ii)(A), and (n)(4)(i).

The revisions and additions read as follows:

§ 1915.1024 Beryllium.

* * * * *

(b) * * *

Beryllium sensitization means a response in the immune system of a specific individual who has been exposed to beryllium. There are no associated physical or clinical symptoms and no illness or disability with beryllium sensitization alone, but the response that occurs through beryllium sensitization can enable the immune system to recognize and react to beryllium. While not every beryllium-sensitized person will develop chronic beryllium disease (CBD), beryllium sensitization is essential for development of CBD.

CBD diagnostic center means a medical diagnostic center that has a pulmonologist or pulmonary specialist on staff and on-site facilities to perform a clinical evaluation for the presence of chronic beryllium disease (CBD). The CBD diagnostic center must have the capacity to perform pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. The CBD diagnostic center must also have the capacity to transfer BAL samples to a laboratory for appropriate diagnostic testing

within 24 hours. The pulmonologist or pulmonary specialist must be able to interpret the biopsy pathology and the BAL diagnostic test results.

Chronic beryllium disease (CBD) means a chronic granulomatous lung disease caused by inhalation of airborne beryllium by an individual who is beryllium-sensitized.

Confirmed positive means the person tested has had two abnormal BeLPT test results, an abnormal and a borderline test result, or three borderline test results from tests conducted within a 3-year period. It also means the result of a more reliable and accurate test indicating a person has been identified as having beryllium sensitization.

* * * * *

(f) * * *

(1) * * *

(i) * * *

(A) A list of operations and job titles reasonably expected to involve exposure to beryllium;

* * * * *

(D) Procedures used to ensure the integrity of each containment used to minimize exposures to employees outside of the containment; and

(E) Procedures for removing, cleaning, and maintaining personal protective clothing and equipment in accordance with paragraph (h) of this standard.

(ii) * * *

(B) The employer is notified that an employee is eligible for medical removal in accordance with paragraph (l)(1) of this standard, referred for evaluation at a CBD diagnostic center, or shows signs or symptoms associated with exposure to beryllium; or

* * * * *

(2) *Engineering and work practice controls.* The employer must use engineering and work practice controls to reduce and maintain employee airborne exposure to beryllium to or below the TWA PEL and STEL, unless the employer can demonstrate that such controls are not feasible. Wherever the employer demonstrates that it is not feasible to reduce airborne exposure to or below the PELs with engineering and work practice controls, the employer must implement and maintain engineering and work practice controls to reduce airborne exposure to the lowest levels feasible and supplement these controls by using respiratory protection in accordance with paragraph (g) of this standard.

* * * * *

(g) * * *

(1) * * *

(iii) During operations for which an employer has implemented all feasible engineering and work practice controls when such controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL; and

* * * * *

(h) * * *

(1) *Provision and use.* Where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL, the employer must provide at no cost, and ensure that each employee uses, appropriate personal protective clothing and equipment in accordance with the written exposure control plan required under paragraph (f)(1) of this standard and OSHA's Personal Protective Equipment standards for shipyards (subpart I of this part).

(2) *Removal of personal protective clothing and equipment.* (i) The employer must ensure that each employee removes all personal protective clothing and equipment required by this standard

at the end of the work shift or at the completion of all tasks involving beryllium, whichever comes first.

(ii) The employer must ensure that personal protective clothing and equipment required by this standard is not removed in a manner that disperses beryllium into the air, and is removed as specified in the written exposure control plan required by paragraph (f)(1) of this standard.

(iii) The employer must ensure that no employee with reasonably expected exposure above the TWA PEL or STEL removes personal protective clothing and equipment required by this standard from the workplace unless it has been cleaned in accordance with paragraph (h)(3)(ii) of this standard.

(3) * * *

(ii) The employer must ensure that beryllium is not removed from personal protective clothing and equipment required by this standard by blowing, shaking, or any other means that disperses beryllium into the air.

* * * * *

(j) *Housekeeping.* (1) When cleaning dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL, the employer must ensure the use of methods that minimize the likelihood and level of airborne exposure.

(2) The employer must not allow dry sweeping or brushing for cleaning up dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL unless methods that minimize the likelihood and level of airborne exposure are not safe or effective.

(3) The employer must not allow the use of compressed air for cleaning where the use of compressed air causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL.

(4) Where employees use dry sweeping, brushing, or compressed air to clean, the employer must provide, and ensure that each employee uses, respiratory protection and personal protective clothing and equipment in accordance with paragraphs (g) and (h) of this standard.

(5) The employer must ensure that cleaning equipment is handled and maintained in a manner that minimizes the likelihood and level of airborne exposure and the re-entrainment of airborne beryllium in the workplace.

(k) * * *

(1) * * *

(i) * * *

(B) Who shows signs or symptoms of CBD or other beryllium-related health effects; or

* * * * *

(2) * * *

(i) * * *

(B) An employee meets the criteria of paragraph (k)(1)(i)(B) of this standard.

(ii) At least every two years thereafter for each employee who continues to meet the criteria of paragraph (k)(1)(i)(A), (B), or (C) of this standard.

* * * * *

(3) * * *

(ii) * * *

(A) A medical and work history, with emphasis on past and present exposure to beryllium, smoking history, and any history of respiratory system dysfunction;

* * * * *

(4) * * *

(i) A description of the employee's former and current duties that relate to the employee's exposure to beryllium;

* * * * *

(7) * * *

(i) The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The evaluation at the CBD diagnostic center must be scheduled within 30 days, and must occur within a reasonable time, of:

* * * * *

(ii) The evaluation must include any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. If any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may be performed at another location that is mutually agreed upon by the employer and the employee.

* * * * *

(m) * * *

(1) * * *

(ii) Employers must include beryllium in the hazard communication program established to comply with the HCS. Employers must ensure that each employee has access to labels on containers of beryllium and to safety data sheets, and is trained in accordance with the requirements of the HCS (29 CFR 1910.1200) and paragraph (m)(3) of this standard.

* * * * *

(3) * * *

(i) For each employee who has, or can reasonably be expected to have, airborne exposure to beryllium;

* * * * *

(ii) * * *

(A) The health hazards associated with exposure to beryllium, including the signs and symptoms of CBD;

* * * * *

(D) Measures employees can take to protect themselves from exposure to beryllium;

* * * * *

(iv) The employer must make a copy of this standard and its appendices readily available at no cost to each employee and designated employee representative(s).

(n) * * *

(1) * * *

(ii) * * *

(F) The name and job classification of each employee represented by the monitoring, indicating which employees were actually monitored.

* * * * *

(3) * * *

(ii) * * *

(A) Name and job classification;

* * * * *

(4) * * *

(i) At the completion of any training required by this standard, the employer must prepare a record that indicates the name and job classification of each employee trained, the date the training was completed, and the topic of the training.

* * * * *

PART 1926—SAFETY AND HEALTH REGULATIONS FOR CONSTRUCTION

Subpart Z—Toxic and Hazardous Substances

3. The authority citation for part 1926, subpart Z, continues to read as follows:

Authority: 40 U.S.C. 3704; 29 U.S.C. 653, 655, 657; and Secretary of Labor’s Order No. 12-71 (36 FR 8754), 8-76 (41 FR 25059), 9-83 (48 FR 35736), 1-90 (55 FR 9033), 6-96 (62 FR 111), 3-2000 (65 FR 50017), 5-2002 (67 FR 65008), 5-2007 (72 FR 31160), 4-2010 (75 FR 55355), or 1-2012 (77 FR 3912) as applicable; and 29 CFR part 1911.

Section 1926.1102 not issued under 29 U.S.C. 655 or 29 CFR part 1911; also issued under 5 U.S.C. 553.

4. Amend § 1926.1124 by:

a. In paragraph (b), add a definition for “Beryllium sensitization” in alphabetical order, revise the definitions for “CBD diagnostic center,” “Chronic beryllium disease (CBD),” and “Confirmed positive,” and remove the definitions of “Emergency” and “High-efficiency particulate air (HEPA) filter.”

- b. Revise paragraph (f)(1)(i)(A).
- c. Remove paragraphs (f)(1)(i)(B), (C), (D), (E), and (H).
- d. Redesignate paragraphs (f)(1)(i)(F), (G), and (I) as paragraphs (f)(1)(i)(B), (C), and (D).
- e. Remove the period at the end of newly redesignated paragraph (f)(1)(i)(D) and add a semicolon in its place.
- f. Add new paragraphs (f)(1)(i)(E) and (F).
- g. Revise paragraphs (f)(1)(ii)(B), (f)(2), and (g)(1)(iii).
- h. Remove paragraph (g)(1)(iv).
- i. Redesignate paragraph (g)(1)(v) as paragraph (g)(1)(iv).
- j. Revise paragraphs (h)(1) and (2) and (h)(3)(ii).
- k. Remove paragraph (h)(3)(iii).
- l. Remove and reserve paragraph (i).
- m. Revise paragraphs (j) and (k)(1)(i)(B).
- n. Remove paragraph (k)(1)(i)(C).
- o. Redesignate paragraph (k)(1)(i)(D) as paragraph (k)(1)(i)(C).
- p. Revise paragraphs (k)(2)(i)(B), (k)(2)(ii), (k)(3)(ii)(A), (k)(4)(i), and (k)(7)(i) introductory text.
- q. Redesignate paragraphs (k)(7)(ii) through (v) as paragraphs (k)(7)(iii) through (vi).
- r. Add a new paragraph (k)(7)(ii).
- s. Remove paragraph (m)(2).
- t. Redesignate paragraph (m)(3) as paragraph (m)(2).
- u. Revise newly redesignated paragraphs (m)(2)(i) introductory text and (m)(2)(ii)(A).
- v. Remove newly redesignated paragraph (m)(2)(ii)(D).

w. Further redesignate newly redesignated paragraphs (m)(2)(ii)(E) through (I) as paragraphs (m)(2)(ii)(D) through (H).

x. Revise newly redesignated paragraphs (m)(2)(ii)(D) and (m)(2)(iv) and paragraphs (n)(1)(ii)(F), (n)(3)(ii)(A), and (n)(4)(i).

The revisions and additions read as follows:

§ 1926.1124 Beryllium.

* * * * *

(b) * * *

Beryllium sensitization means a response in the immune system of a specific individual who has been exposed to beryllium. There are no associated physical or clinical symptoms and no illness or disability with beryllium sensitization alone, but the response that occurs through beryllium sensitization can enable the immune system to recognize and react to beryllium. While not every beryllium-sensitized person will develop chronic beryllium disease (CBD), beryllium sensitization is essential for development of CBD.

CBD diagnostic center means a medical diagnostic center that has a pulmonologist or pulmonary specialist on staff and on-site facilities to perform a clinical evaluation for the presence of chronic beryllium disease (CBD). The CBD diagnostic center must have the capacity to perform pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. The CBD diagnostic center must also have the capacity to transfer BAL samples to a laboratory for appropriate diagnostic testing within 24 hours. The pulmonologist or pulmonary specialist must be able to interpret the biopsy pathology and the BAL diagnostic test results.

Chronic beryllium disease (CBD) means a chronic granulomatous lung disease caused by inhalation of airborne beryllium by an individual who is beryllium-sensitized.

* * * * *

Confirmed positive means the person tested has had two abnormal BeLPT test results, an abnormal and a borderline test result, or three borderline test results from tests conducted within a 3-year period. It also means the result of a more reliable and accurate test indicating a person has been identified as having beryllium sensitization.

* * * * *

(f) * * *

(1) * * *

(i) * * *

(A) A list of operations and job titles reasonably expected to involve exposure to beryllium;

* * * * *

(E) Procedures used to ensure the integrity of each containment used to minimize exposures to employees outside the containment; and

(F) Procedures for removing, cleaning, and maintaining personal protective clothing and equipment in accordance with paragraph (h) of this standard.

(ii) ***

(B) The employer is notified that an employee is eligible for medical removal in accordance with paragraph (l)(1) of this standard, referred for evaluation at a CBD diagnostic center, or shows signs or symptoms associated with exposure to beryllium; or

* * * * *

(2) *Engineering and work practice controls.* The employer must use engineering and work practice controls to reduce and maintain employee airborne exposure to beryllium to or below the TWA PEL and STEL, unless the employer can demonstrate that such controls are not feasible. Wherever the employer demonstrates that it is not feasible to reduce airborne exposure to or below the PELs with engineering and work practice controls, the employer must implement and maintain engineering and work practice controls to reduce airborne exposure to the lowest levels feasible and supplement these controls by using respiratory protection in accordance with paragraph (g) of this standard.

* * * * *

(g) * * *

(1) * * *

(iii) During operations for which an employer has implemented all feasible engineering and work practice controls when such controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL; and

* * * * *

(h) * * *

(1) *Provision and use.* Where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL, the employer must provide at no cost, and ensure that each employee uses, appropriate personal protective clothing and equipment in accordance with the written exposure control plan required under paragraph (f)(1) of this standard and OSHA's Personal Protective and Life Saving Equipment standards for construction (subpart E of this part).

(2) *Removal of personal protective clothing and equipment.* (i) The employer must ensure that each employee removes all personal protective clothing and equipment required by this standard at the end of the work shift or at the completion of all tasks involving beryllium, whichever comes first.

(ii) The employer must ensure that personal protective clothing and equipment required by this standard is not removed in a manner that disperses beryllium into the air, and is removed as specified in the written exposure control plan required by paragraph (f)(1) of this standard.

(iii) The employer must ensure that no employee with reasonably expected exposure above the TWA PEL or STEL removes personal protective clothing and equipment required by this standard from the workplace unless it has been cleaned in accordance with paragraph (h)(3)(ii) of this standard.

(3) * * *

(ii) The employer must ensure that beryllium is not removed from personal protective clothing and equipment required by this standard by blowing, shaking, or any other means that disperses beryllium into the air.

* * * * *

(j) *Housekeeping.* (1) When cleaning up dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL, the employer must ensure the use of methods that minimize the likelihood and level of airborne exposure.

(2) The employer must not allow dry sweeping or brushing for cleaning up dust resulting from operations that cause, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL unless methods that minimize the likelihood and level of airborne exposure are not safe or effective.

(3) The employer must not allow the use of compressed air for cleaning where the use of compressed air causes, or can reasonably be expected to cause, airborne exposure above the TWA PEL or STEL.

(4) Where employees use dry sweeping, brushing, or compressed air to clean, the employer must provide, and ensure that each employee uses, respiratory protection and personal protective clothing and equipment in accordance with paragraphs (g) and (h) of this standard.

(5) The employer must ensure that cleaning equipment is handled and maintained in a manner that minimizes the likelihood and level of airborne exposure and the re-entrainment of airborne beryllium in the workplace.

(k) * * *

(1) * * *

(i) * * *

(B) Who shows signs or symptoms of CBD or other beryllium-related health effects; or

* * * * *

(2) * * *

(i) * * *

(B) An employee meets the criteria of paragraph (k)(1)(i)(B) of this standard.

(ii) At least every two years thereafter for each employee who continues to meet the criteria of paragraph (k)(1)(i)(A), (B), or (C) of this standard.

* * * * *

(3) * * *

(ii) * * *

(A) A medical and work history, with emphasis on past and present exposure to beryllium, smoking history, and any history of respiratory system dysfunction;

* * * * *

(4) * * *

(i) A description of the employee's former and current duties that relate to the employee's exposure to beryllium;

* * * * *

(7) * * *

(i) The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The evaluation at the CBD diagnostic center must be scheduled within 30 days, and must occur within a reasonable time, of:

* * * * *

(ii) The evaluation must include any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. If any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may be performed at another location that is mutually agreed upon by the employer and the employee.

* * * * *

(m) * * *

(2) * * *

(i) For each employee who has, or can reasonably be expected to have, airborne exposure to beryllium:

* * * * *

(ii) * * *

(A) The health hazards associated with exposure to beryllium, including the signs and symptoms of CBD;

* * * * *

(D) Measures employees can take to protect themselves from exposure to beryllium;

* * * * *

(iv) The employer must make a copy of this standard and its appendices readily available at no cost to each employee and designated employee representative(s).

(n) * * *

(1) * * *

(ii) * * *

(F) The name and job classification of each employee represented by the monitoring, indicating which employees were actually monitored.

* * * * *

(3) * * *

(ii) * * *

(A) Name and job classification;

* * * * *

(4) * * *

(i) At the completion of any training required by this standard, the employer must prepare a record that indicates the name and job classification of each employee trained, the date the training was completed, and the topic of the training.

* * * * *

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